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ANNOTATED BIBLIOGRAPHY OF SCRUB TYPHUS IN TAIWAN AND THE PESCAD--ETC(U)
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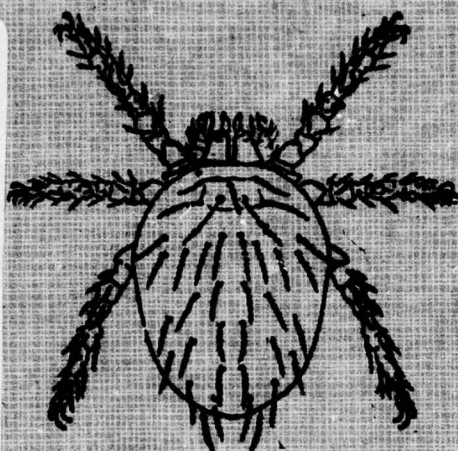
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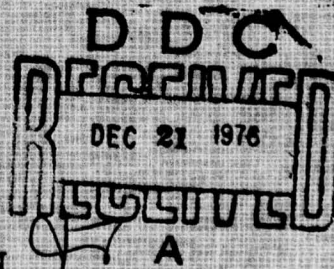
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**ANNOTATED
BIBLIOGRAPHY OF SCRUB
TYPHUS IN TAIWAN AND
THE PESCADORES ISLANDS
(1911-1975)**

**FREDERICK J. SANTANA
JIH C. LIEN
P. F. DIRK VAN PEENEN
RICHARD SEE**



**A SPECIAL PUBLICATION
OF
U.S. NAVAL MEDICAL RESEARCH UNIT NO. 2
TAIPEI, TAIWAN
1976**

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of

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ANNOTATED BIBLIOGRAPHY OF SCRUB TYPHUS
IN TAIWAN AND THE PESCADORES ISLANDS*
(1951-1975). per cover

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by
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TAIPEI, TAIWAN

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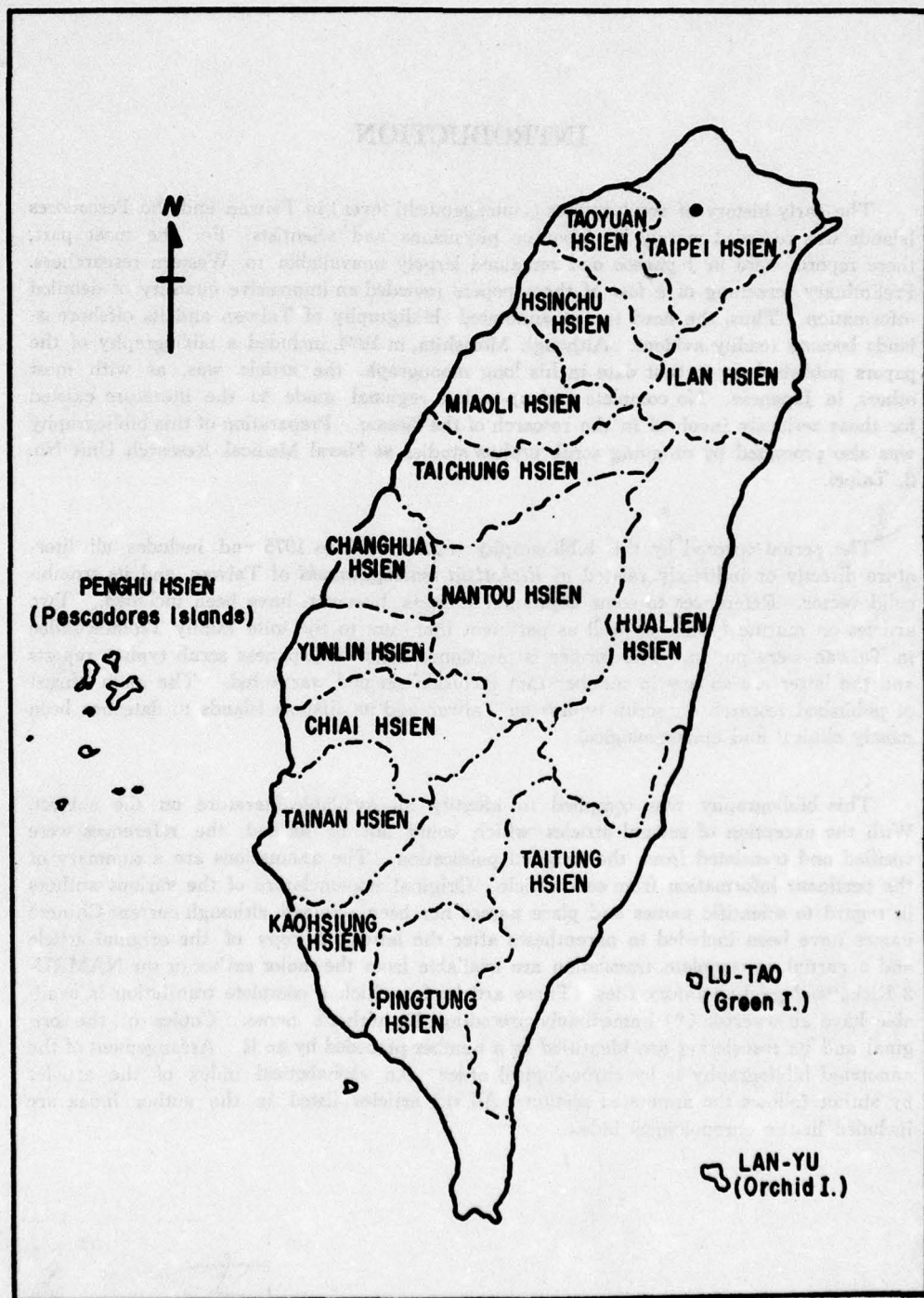
INTRODUCTION

The early history of scrub typhus (tsutsugamushi fever) in Taiwan and the Pescadores Islands was recorded mainly by Japanese physicians and scientists. For the most part, these reports were in Japanese and remained largely unavailable to Western researchers. Preliminary screening of a few of these papers revealed an impressive quantity of detailed information. Thus, the need for an annotated bibliography of Taiwan and its offshore islands became readily evident. Although Morishita, in 1934, included a bibliography of the papers published up to that date in his long monograph, the article was, as with most others, in Japanese. No complete and up-to-date regional guide to the literature existed for those seriously involved in the research of the disease. Preparation of this bibliography was also prompted by on-going scrub typhus studies at Naval Medical Research Unit No. 2, Taipei.

The period covered by this bibliography is from 1911 to 1975 and includes all literature directly or indirectly related to *Rickettsia tsutsugamushi* of Taiwan and its trombiculid vector. References to some additional subjects, however, have been included. Two articles on murine typhus as well as pertinent literature to the mite family Trombiculidae in Taiwan were put in. The former is mentioned often in Japanese scrub typhus reports and the latter are so few in number that inclusion seemed warranted. The main thrust of published research on scrub typhus on Taiwan and its offshore islands to date has been mostly clinical and epidemiological.

This bibliography was compiled to identify all available literature on the subject. With the exception of several articles which could not be located, the references were verified and translated from the original publication. The annotations are a summary of the pertinent information from each article. Original nomenclature of the various authors in regard to scientific names and place names has been retained, although current Chinese names have been included in parentheses after the latter. A copy of the original article and a partial or complete translation are available from the senior author or the NAMRU-2 Rickettsiology Laboratory files. Those articles for which a complete translation is available have an asterisk (*) immediately preceding the author's name. Copies of the original and its translation are identified by a number preceded by an R. Arrangement of the annotated bibliography is by chronological order. An alphabetical index of the articles by author follows the annotated section. All the articles listed in the author index are included in the chronological index.

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Taiwan and its offshore islands

CHRONOLOGICAL INDEX

- R443 **Kato, S.** 1911. Observations on the spotted typhus-like fever in Formosa. *J. Formosan Med. Assoc.*, No. 100: 157-164 (In Japanese).

In a meeting presentation, a Japanese physician describes two patients admitted to a Kagi (Chia-i) hospital with spotted fever. Both were Japanese males working on the Arisan (Ali-shan) Railroad Line. One was a 24 year old who experienced a sudden attack of fever on 5 October. Headache and rash developed on 11 October, and there were cerebral symptoms on 19 October. His fever and symptoms gradually subsided and he was discharged on 21 November. The second case had probably been exposed at an elevation of 3500 feet. He was 39 years old with past history of malaria, most recently in June 1911. He had fever and chills on 8 October and rash on 13 October. He was hospitalized 15 October with a fever of 39.5°C and pulse of 130. *Plasmodium falciparum* was seen in blood smears, perhaps representing a dual infection. His fever subsided by 21 October and pulse slowed (as with the other patient during convalescence) to 32-36. He was discharged well on 21 November. Although the author calls these cases spotted-fever-like, he does not mention eschars nor lymphadenopathy.

- R454 **Nijima, Y.** 1913. Spotted fever unknown disease. *J. Formosan Med. Assoc.*, No. 125: 54 (In Japanese).

A brief note on more than 10 cases from Takao (Kaohsiung) which may have been dengue or a rickettsiosis.

- R207 ***Nakagawa, K.** 1913. A kind of spotted fever found in Karenko. *J. Formosan Med. Assoc.*, No. 125: 210-211 (In Japanese).

In a meeting presentation, a Japanese physician stationed in Karenko (Hualien) briefly described 4 cases (2 deaths) of a febrile illness with rash.

- R435 **Sano, K.** 1914. On the eruptive unknown fever. *J. Formosan Med. Assoc.*, No. 130-139: 466-477 (In Japanese).

In what is probably a meeting presentation, the author gives 2 case reports on febrile illness with rash in Japanese males hospitalized in Kagi (Chia-i). The first case, a 40 year old, had come from Japan 12 years previously and had a past history of malaria. On 27 May he experienced onset of illness with fever, cough and headache prominent the next day. He was hospitalized on 31 May with fever of 39°C and pulse of 90 and slight splenomegaly and hepatomegaly. By 1 June the fever had subsided and rash had appeared. On 2 June his eyeball became "hemorrhagic". He became delirious on 5 June, but fever subsided 9 June and he was discharged on 16 June. The second case was 42 years old and also had a past history of malaria. He became febrile on 1 June and was hospitalized on 5 June. He had cerebral symptoms with disorientation on 6 June when his tem-

perature was 39.9°C. Rash appeared on 7 June, but he was able to be discharged on 18 June.

Both cases had been on Arisan (Alishan) 10 days before onset of illness and both had been attacked by land leeches. The author does not mention eschars nor lymphadenopathy.

- R199 **Hatori, J.** 1915. A report of the investigation on eruptive lymphadenitis fever in Formosa (I). *J. Formosan Med. Assoc.*, No. 147: 1-90, Fig. 1-12 (In Japanese).

The first monograph on scrub typhus in Taiwan, by a Japanese government preventive medicine official, based on his own extensive experience on the island. Hatori called the disease exanthematous bubonic fever. Chapter 1 gives a list of synonyms for the disease in Taiwan: moku fever, batoran fever, horin fever, unknown fever, spotted fever and spotted febrile disease. Chapter 2 presents epidemiological and distribution data for Karenko Prefecture (Hualien Hsien) where the disease was first noticed, as well as Giran and Kagi Prefectures (Ilan and Chia-i Hsiens). He recognized the disease as essentially identical with river fever of Japan and "pseudotyphus" of Sumatra and was aware of previous reports from Taiwan. Extensive case reports are given with highest death rates in the aged and females, more cases in Japanese than in Taiwanese, and lowest morbidity amongst aborigines. 250 cases were recorded from 1912 to 1914 with 23 deaths: 9.1% mortality. Chapter 3 gives the results of his unsuccessful attempt to isolate the disease agent and reviews the role of "red mites" in the transmission of the disease, including a list of the vertebrate hosts and measurements of a larval red mite. He considered the larval red mites to be synonymous with *Trombidium akamushi* Brumpt, of Japan. He also transmitted the disease to *Macaca cyclopis* by inoculation of whole blood from a patient. Chapter 4 concludes with a discussion of the symptoms, treatment, diagnosis and prevention of the disease, again re-emphasizing the concordance of the disease with tsutsugamushi disease of Japan.

- R197 **Hatori, J.** 1915. Further report of the investigation on eruptive lymphadenitis fever in Formosa. *J. Formosan Med. Assoc.*, No. 150: 610-624 (In Japanese).

Even though "II" is not listed in the title, this is the second of a series of papers by Hatori in this journal. He reports additional cases for 1914 and extends the geographic range of scrub typhus in Taiwan to a new area: 3 cases from Ako Prefecture (Pingtung Hsien). The majority of the additional cases are from Karenko Prefecture (Hualien Hsien). Most cases occurred in April-December, with peaks in June and September. There were 314 cases recorded in 1914 versus only 60 in 1913. Camphor tree loggers accounted for most of the cases, and the seasonal distribution of the cases may reflect this activity.

- R206 **Hatori, J.** 1915. On the newly found adults of *akamushi*. *J. Formosan Med. Assoc.*, No. 153: 737-740 (In Japanese).

Preliminary report of a special trip to Karenko (Hualien) to collect the adult stage of what Hatori thought to be the "red mite" vector of tsutsugamushi disease in Taiwan.

Hatori gives a brief description, and circulates a specimen that he believes to be an adult, at a meeting of the Formosan Medical Association. The adult specimen was collected from soil in the immediate vicinity of where a sentinel monkey and sentinel mice had picked up larval mites. He intends to send adult specimens to Dr. Miyajima of Japan to learn if they are identical with adult material of the tsutsugamushi disease vector from the Niigata district. He considers the larval red mite chiggers of Taiwan to be the same as those in Japan.

R550 **Hatori, J.** 1915. Tsutsugamushi disease in Formosa. *Dobutsu Gaku Zasshi*, 27(317):155-156 (In Japanese).

The author reiterates his opinion that the febrile illness of Karenko and Horin Districts is in fact tsutsugamushi disease. He found red mites, which he identified as *Trombidium akamushi* Brumpt, on various rodents and on *Crocidura muschata* (= *Suncus murinus*). Hatori considered "sand mites" or "sand lice" of South China as identical with red mites.

R445 **Hatori, J.** 1916. On the concordance of eruptive lymphadenitis fever in Formosa with tsutsugamushi disease. *Nippon Eisei Gakkai, Zasshi*, 11(6):415-449 (In Japanese).

Gale, et al (1974) cited this paper as saying Japanese workers first described tsutsugamushi fever on Taiwan in 1908. However, in his introduction to this long monograph, Hatori states the disease was first recognized during an outbreak among Japanese police officers and other people engaged in the construction of a defensive outpost against aborigines in Karenko (Hualien Hsien). No one person or reference are cited by Hatori, who, as a Japanese government health officer, probably gathered this information from local prefectural health record files. At the time of this outbreak, the disease was then referred to as a kind of spotted fever of unknown causes.

Chapter 1 lists epidemiological data. In 1914, there were 5 deaths in an outbreak of 29, 2 of 19 in another and 13 of 90 in another. Distributional and seasonal data are given. Most disease was amongst newly-arrived Japanese transmigrants and least in aborigines. Chapter 2 concerns the etiological agent and vector. Hatori recognized the former as submicroscopic and reproduced it experimentally in *Macaca cyclopis*. He stated that the red mite vectors are widely distributed on birds and mammals and presents photomicrographs of larval and adult stages of the presumed vector. The latter, however, do not appear to be mites of the family Trombidiidae. The author placed sentinel monkeys, *Macaca cyclopis*, in "noxious areas" and observed them become febrile with lymphadenopathy. He pointed out that Dr. Miyajima of Japan considered monkeys from "noxious areas" were immune and thus not suitable for experimental infection.

Chapter 3 gives clinical observations, and an appendix lists 6 case histories. Recommended and unsuccessful methods of treatment as well as differential diagnoses from typhoid, plague and malaria are included. Atypical cases are those without rash.

Chapter 4 compares the Formosan disease with tsutsugamushi or Kedani fever of Japan, and Hatori concludes they are the same. Chapter 5 concerns prevention, including use of protective clothing and repellents. There are 30 references. A complete translation of chapter 2, which includes the mite descriptions, is available.

- R195 Hatori, J. 1916. Report of the investigation on exanthematous bubonic fever in Formosa. (III). *J. Formosan Med. Assoc.*, No. 170:963-990 (In Japanese).

The third article in a series by Hatori in this journal presents additional cases for Ako and Karenko Prefectures (Pingtung and Hualien Hsien). With the exception of 6, all additional cases are from Karenko Prefecture, primarily in Japanese transmigrant villages. Statistics for 118 cases in Karenko Prefecture are given. In one village, only 1 of 21 patients had an eschar, while in other villages 4 of 8, 24 of 35, 5 of 10, and 6 of 8 had eschars. Other clinical observations are discussed as well as attempts to demonstrate rickettsiae and his experimental infection of monkeys. Although he felt he saw rickettsiae in Giemsa stain preparations, he was not certain and intended to send slides to Dr. Nagayo in Japan for confirmation. Staking out of monkeys (*Macaca cyclopis*) in "noxious areas" and inoculating them with blood from human cases resulted in fever, lymphadenitis and even the death of one monkey; however, passage of spleen material from a febrile monkey into a healthy monkey yielded no response. Hatori documents the various kinds of free-living and parasitic mites he has encountered, particularly adult mites of the family Trombididae (*sic*). He considers the larval "red mites" of Formosa synonymous with *Leptotrombidium akamushi* of Japan, but has yet to confirm the red mite adults. Various adult trombidid mites that he previously referred to as adults of the red mites were found to include Nagayo's species A and B which he felt were *Trombidium globiferum* and *T. fuliginosum* respectively.

He also documents a case history of a patient presumably bitten on the foot by a tick. The patient developed high fever and swollen left inguinal lymph gland but had no eschar. The tick was lost but according to Hatori probably belonged to the genus *Boophilus* since it is so common in Karenko Prefecture.

- Sekami, N. 1917. A case of tsutsugamushi disease in Arisan. *Kagi Igaku Gakkai Hokoku*. Volume and pages unknown (In Japanese). (As cited by R. Kawamura in: Studies on tsutsugamushi disease (Japanese flood fever). *Med. Bull. Coll. Med., Univ. Cincinnati*, 4:229 p., 1926).

Not seen.

- R198 Hatori, J. 1917. Further report on the tsutsugamushi disease of Formosa (IV). *J. Formosan Med. Assoc.*, No. 181:778-796 (In Japanese).

The fourth of Hatori's Formosan reports in this journal largely concerns the chiggers he has encountered in endemic scrub typhus localities of the Karenko (Hualien) area. He was aware of the work going on in Japan by Dr. M. Nagayo and co-workers, and considered 1 of the 2 species he obtained to be synonymous with *Trombicula* (= *Leptotrombidium*) *akamushi* of Japan. The second one was considered different and is described as a new species: *Trombicula pseud-akamushi*. Hatori felt he collected the adult of *T. akamushi* but lost the specimen before he was able to give more than a brief naked-eye description. Observations and measurements of what he considered to be larvae of *T. akamushi* from outdoors (unattached), monkeys, man and chickens are given. Observations and measurements of nymphal *T. akamushi* reared from chiggers attached to rodent

ears are also given. *Trombicula pseud-akamushi* sp. nov., is described on the basis of adult material collected from Yoshino (Chian), Karenko Prefecture (Hualien Hsien). Attempts to rear adults of *T. pseud-akamushi* from eggs to obtain positively associated larvae and nymphs failed. However, Hatori recognized a larval mite redder in color and more active than *T. akamushi* which he provisionally called "akamushimodoki". He felt these redder-colored larvae might be *T. pseud-akamushi*. A brief description and measurements of the "akamushimodoki" are supplied in an appendix following the description and discussion of *T. pseud-akamushi*. Specimens of *T. pseud-akamushi* sp. nov. and the "akamushimodoki" were sent to Japan for detailed examination by Drs. Miyajima and Okumura who concluded that *T. pseud-akamushi* was a synonym of *T. mediocris* Berlese and that the akamushimodoki was *Leptus autumnalis*.

Chapter 2 gives additional findings on the geographical distribution of more scrub typhus cases in Shinchiku and Kagi Prefectures (Hsinchu and Chia-i Hsiens).

The third and final section summarizes scrub typhus cases that have occurred in Karenko Prefecture (Hualien Hsien) during 1916, including statistics for 3 official transmigrant villages and the Prefecture in general. The numbers of cases for each grouping were much less than the previous year: Transmigrant villages: 47 cases (2 deaths) versus 108 cases (11 deaths) in 1915; Prefecture in general: 13 cases (4 deaths) versus 118 cases in 1915.

R474 **Miyajima, K. and T. Okumura.** 1917. A comparative study of *akamushi* and allied mites from Japan, Korea and Formosa. *Saikingaku Zasshi*, No. 266: 983-907, pl. 1-3 (In Japanese).

The authors seek to determine whether mites referred to as *akamushi* in Japan, Korea and Formosa are conspecific. Although actually implying *Trombicula akamushi*, the name is only used alone because of uncertainty as to which genus *akamushi* belongs. After detailed chaetotaxic study, two forms of *akamushi* are found to occur in each country, a coarse-haired and fine-haired type. The differences are considered to be due to seasonal variation. In addition to *akamushi*, two other chiggers are examined: A species of larval chigger obtained from Hatori in Formosa is found to be synonymous with *Leptus autumnalis*. An adult *Trombicula* sp., also supplied by Hatori and collected from the same locality as the larval species, is considered to be identical with *T. mediocris* Berlese. Eight chigger species which are referred to only by number in a previous paper are now identified. The authors are uncertain about the classification of the family *Trombididae* (*sic*) and give a lengthy discourse about their reasons, mainly emphasizing the lack of consideration of both the adult or larval stages together by various workers. Based on their studies, they feel that *akamushi* and *autumnalis* belong to the same genus. However, because of their inexperience, they are reluctant to place *akamushi* with *autumnalis* in the genus *Leptus* or follow Berlese and place both species in the genus *Trombicula*. The accompanying illustrations of the coarse and fine hair *akamushi* and the 2 chiggers from Formosa are well done.

- R196 **Akagi, K. and T. Rin.** 1918. On a case of Tsutsugamushi disease occurring in Kagi district, Formosa. *J. Formosan Med. Assoc.*, No. **182-183**: 150-154 (In Japanese).

A Japanese Red Cross Physician, the senior author, considers his single case report to be the first definitive report of tsutsugamushi disease for Kagi Prefecture (Chia-i Hsien) on Taiwan. However, Hatori (1917) briefly described this case in the preceding issue (No. 181) of the *Journal of the Formosa Medical Association*. Attempted isolation from blood drawn on the 23rd and 27th day after onset of the illness was negative in guinea pigs and a monkey.

- Hatori, J.** 1918. A comparative study of tsutsugamushi disease of Japan and Formosa. A report to the chairman of the Committee on Endemic and Infectious Diseases of Formosa (In Japanese).

Not seen.

- R023 **Hatori, J.** 1919. On the endemic tsutsugamushi disease of Formosa. *Ann. Trop. Med. Parasitol.*, **13**(3): 233-258 (In English).

An English review paper summarizing Hatori's previous articles which were in Japanese (I through IV).

- R527 **Hatori, J.** 1920. Report on the tsutsugamushi disease in Formosa (V) *J. Formosan Med. Assoc.*, No. **209**: 317-352, pl. II, Fig. 1-6 (In Japanese).

The fifth and last paper on tsutsugamushi disease by Hatori in this journal. Chapter 1 gives statistics on human scrub typhus for Karenko Prefecture (Hualien Hsien): a total of 72 cases in 1917 and 58 cases in 1918. Chapter 2 mentions morbidity for the Nan-wo (Nan-ao) area of Giran Prefecture (I-lan Hien); most cases occurred among camphor tree plantation workers. An appendix lists results of a survey for "fine hair type red mites" on rodents in the town of Nan-wo (Nan-ao). Also briefly presented additional geographical and case history data from Toyen, Tainan and Ako Prefecture (Tao-yuan, Tainan and Pingtung Hsien), chapter 3, for the most part (nearly half of the paper), concerns the taxonomy and biology of 3 avian chigger species, including original descriptions of *Trombicula gallinarum* and *T. corvi*. A discussion on chigger hosts in noxious (endemic) areas and the role of galliform birds (domestic chickens and wild pheasants) as possible reservoirs of *Rickettsia tsutsugamushi* concludes the chapter. Hatori devotes considerable space to clarifying the status of *T. pseudo-akamushi* Hatori, 1917 (spelled *pseud-akamushi* in his original description). The unknown larval chigger, referred to as the "akamushi-modoki" in his 4th (1917) paper (J.F.M.A., No. 181) is now confirmed to be *T. pseudo-akamushi*.

Although *Centropus javanicus* (*C. bengalensis lignator*) also serves as a host for *T. akamushi*, this was the only bird on which *pseudo-akamushi* was found attached. A brief description of the host and its habits are mentioned. Observations and measurements of the nymphal stage and distribution records for the species are given. Hatori disagrees

with Miyajima and Okumura of Japan and considers the adult stage of *pseudo-akamushi* distinct from *T. mediocris* of Java. He further disagrees with their claim that the larval stage (= "akamushimodoki") is synonymous with *Leptus autumnalis*. The larval stage of *T. gallinarum*, chiefly parasitic on domestic chickens, is described. The type locality is not stated but larval material was obtained from Yoshino (Chian) and other localities in Karenko-Prefecture (Hualien Hsien). *T. corvi* is described from chiggers collected off *Corvus macrorhynchus* in Yoshino (Chian). A complete translation of the red mite section of Chapter 3 (pp. 337-346) is available.

Hatori, J. 1920. Tsutsugamushi disease of Formosa. *Taiwan Jiho*. 7 (In Japanese).

Not seen.

R429 **Hatori, J.** 1921. Tsutsugamushi-disease in Formosa, 1). *Trans. 4th Congress Far Eastern Assoc. Trop. Med., Weltevreden, Batavia*, 2: 183 (In English).

This is a short abstract, reproduced in its entirety as follows "(1) The exanthematous fever, endemic in East Formosa and known as Mekkui—or Horin-fever studied and identified by the author. The fever is reported from other parts of the island. It is quite analogical with the tsutsugamushi disease of Japan in its clinical and etiological aspects. (2) The transmitter of the disease is the larva of *Trombicula akamushi* Brumpt, which infests such mammals as rats and mice, and according to my observation, chicken, pheasants and such scratching birds in a mite infested field host the vermin, and it seems to play a chief role in its distribution. (3) In Formosa the noxious or mite infested areas are commonly limited to wild field on river banks or to the foot of the mountain and thickly wooded lands, irrespective of inundation. (4) Seasonal prevalence of the disease is from April to November. Mortality of the patients 10—8%. (5) It is a problem to exterminate the mite in an infested field. Prevention of labourers from mite bite is not easy." A footnote reads "Summary. Paper not received."

R060 **Kawamura, R. and M. Yamaguchi.** 1921. Ueber die tsutsugamushi-krankheit in Formosa, Zugleich eine vergleichende studie derselben mit der in Nordjapan. *Kitasato Arch. Exper. Med.*, 4(3): 169-206, pl. I-VII (In German).

Two Japanese physicians, experienced in the study of scrub typhus in Japan, visited Taiwan in 1920. They were well-versed on Hatori's publications and traveled to areas of previous outbreaks in Kagi (Chia-i), Ako (Pingtung) and Karenko (Hualien) districts, searching for *Trombicula akamushi* and examining human cases. Clinical observations on 16 cases in a hospital near Karenko (Hualien) are given, with detailed symptoms for 5 cases, aged 8-16, included. An absence of eschar in several cases was noted along with lengthy discussion of the etiology and epidemiology of the disease. Comments on the chiggers are mainly restricted to species previously encountered or described by Hatori. The authors felt *T. akamushi* of Formosa was identical with *T. akamushi* of Japan. All life stages of *T. akamushi*, *T. pseudoakamushi* (non Tanaka) and *T. gallinarum* were collected and examined. However, Hatori's *T. pseudoakamushi* was considered to be probably *T.*

mediocris Berlese and captions of the illustrations for this species refer to it as *T. mediocris*? A large portion of the section on chiggers is devoted to a detailed redescription of a scrub itch chigger from Parao Island in the Caroline Islands. This chigger, known as a "Karasos" had been described in a recent article by a Japanese Naval physician as being similar to *T. gallinarum* Hatori but which the authors clearly show is different from *T. gallinarum*. Detailed illustrations of "Karasos" which the authors call *Trombicula* sp. from Parao I., are provided in plate VIII. It would appear from the description to be a species of *Schoengastia*; scutal setae at the dorsolateral angle (AL setae) are described as the longest but in the illustration the PL setae are longer than the AL's. A specimen of *T. corvi* Hatori was borrowed from Hatori's collection and morphological details given in Table III. However, unlike the other species discussed, no illustrations of *T. corvi* are provided.

The authors conclude that the Taiwan disease is similar to Japanese tsutsugamushi, but milder. They reproduced Taiwan disease in *Macaca fuscatus* (which was then immune to Japanese scrub typhus) but not in rabbits nor white rats (presumably *R. norvegicus*). English translations of portions of this paper, including the section on chiggers, are available.

- R529 *Mukoyama, K. 1922. On the source of the causative agent of tsutsugamushi disease. *J. Formosan Med. Assoc.*, No. 220: 70-71 (In Japanese).

In a lecture presented at a Taipei Hospital, the author briefly discusses his experiments to clarify the question of whether chiggers acquire the causative agent of tsutsugamushi disease transovarially as claimed by Drs. Nagayo and Kawamura or by feeding on an infected wild rodent host as claimed by Dr. Hayashi. Prior to these experiments, he had already demonstrated that chiggers would reattach and feed on a different host and that they ingest tissue fluids and white cells. He also asserted that only those chiggers that fed upon infected wild rodents became infected.

In his experiments he obtained uninfected, "non-noxious" chiggers by collecting chiggers that had detached from healthy rabbits and reattached to other animals. If the other animals did not show signs of disease, these chiggers were considered "non-noxious" and used for the experiment. The presumably uninfected chiggers were next allowed to attach and feed on animals showing typical signs of tsutsugamushi disease. After feeding for a period of time and naturally detaching, the chiggers were finally fed on guinea pigs which were then observed for signs of disease. According to the author, uninfected "non-noxious" chiggers that had fed on infected animals caused healthy animals (guinea pigs) to become ill, and thus proved Dr. Hayashi's theory that chiggers acquired the disease agent from infected wild rodents. He had not been able to repeat the work of Nagayo and Kawamura, and therefore could not rule out their theory of transovarial transmission. The author refers to *Chuo Igakkai Zasshi*, Vol. 28, No. 6 for exact details of his experiment. The indicated reference was located and found to be a two part article in the same volume and number with the following title and pagination: Mukoyama, K. 1921. Additional knowledge on tsutsugamushi disease. *Chuo Igakkai Zasshi*, 28(6): 517-567; 1921. Additional knowledge on tsutsugamushi disease (2nd report). *Chuo Igakkai Zasshi*, 28(6): 584-619 (In Japanese).

- R528 **Hatori, J.** 1922. Observation tour to South Asian Islands. *J. Formosan Med. Assoc.*, No. **224**: 518-529 (In Japanese).

Hatori presents a detailed trip report of his travels over a 130 day period to Southeast Asia, Indonesia and Australia. Departing Keelung (Chilung) on 6 Dec. 1921 he stopped enroute at Hong Kong and then Saigon. While in Saigon he went to Bien Hoa where two cases of tsutsugamushi disease had been reported. Proceeding next to Kuala Lumpur, via Singapore, he met with Dr. Fletcher. After a brief stay he traveled to Tandjung Morawa, Medan and the Deli area in Sumatra where he met Dr. Schuffner and Dr. Walch. The latter accompanied him to villages and plantations in the Medan area where he collected *Trombicula mediocris*, *T. schuffneri*, *T. deliensis* and *T. pseudoakamushi*. After about a 15 day stay, he left Sumatra and sailed for Java, visiting Batavia (Jakarta), Bogor, Bandung and many cities in Java. While there he met with Dr. Rodenwaldt. From Java he traveled to Australia, spending approximately one month visiting various sites and people in Queensland. Retracing many of his stops, he returned home on 7 April 1922.

- R530 **Matsumoto, R.** 1930. On the tsutsugamushi disease of Kagi District. *J. Formosan Med. Assoc.*, No. **303**: 632-638 (In Japanese).

The author, a worker in a Kagi (Chia-i) Hygiene Laboratory, reviews the past knowledge of the disease in Kagi District (Chia-i Hsien), mentioning reports of Kato (1911), Sano (1914), Akagi and Rin (1918) and Kawamura and Yamaguchi (1921). A case history of an engineer on the Arisan (Alishan) Railroad Line who died of the disease, and presumably acquired it in 1929 in the foothills along the Line, is described in great detail but no autopsy was performed. Prompted by the diagnosing physician, he conducted a small survey for chiggers along the Line near present day Chiao-li-ping. "Red mites" from a few rats were examined and described. The description does not fit *Leptotrombidium deliense*, although he felt it was *L. akamushi*.

- R385 **Miyairi, K.** 1930. Gleanings on the way in pursuing the causative agent of tsutsugamushi disease. *Tokyo Iji Shinshi*, No. **2689**: 1900-1903, Photos 1-4 (In Japanese).

Miyairi, a retired Emeritus Professor at Kyushu Imperial University, erroneously tries to prove his claim that a hematozoon is the causative agent of scrub typhus. He apparently thought a haemogregarine (probably an Hepatozoon of rodents) was involved. In support of his thesis, photomicrographs demonstrating schizont-like organisms in human blood films of 3 persons from Karenko Prefecture (Hualien Hsien) and the serial section of a lung of a mouse from Japan are shown. In addition, he reports a higher incidence of *Haemogregarina* in field rodents from "noxious" than from non-noxious areas in Taiwan (87 of 115 rats versus 2 of 16).

- R491 **Ogata, K.** 1930. A story on the study tour to Formosa. *J. Chiba Med. Assoc.*, **8**(3): 84-89 (In Japanese).

Ogata visited Formosa to obtain first hand information on scrub typhus. He arrived at Kee-lung (Chi-lung) by ship on 17 January 1930, but it is not stated how long he

feel *Rickettsia* were living things. He acknowledges that chiggers are the vector of tsutsugamushi disease and speculates that the etiologic agent of the disease alternately parasitizes field mice and chiggers, drawing an analogy between tsutsugamushi disease and malaria. He then explains the life cycle of a saurian haemogregarine which is transmitted by a mite.

R391 *Naritomi, C. 1932. Studies on the unknown fever of the Pescadores. *J. Formosan Med. Assoc.*, **31**(12): 1412 (In Japanese).

Abstract of a presentation by a physician from a hospital in the Pescadores who reports on the inoculation of a suspected scrub typhus patient's blood into the preocular cavity of a rabbit. *Rickettsiae* presumed to be *Rickettsia orientalis* were seen after Giemsa staining of ocular endothelial cells. There is an addendum on page 1413 by T. Yamamiya and T. Matsumoto. The former describes a female case with abortion and 2 other cases in the same family. He also obtained "red mites" from a house rat and the ear lobe of a dog at the home of the patients. The author points out the fact that larval tsutsugamushi do not reattach after detaching; therefore, the patients Yamamiya saw must have been bitten by red mites during an outing or in the garden.

R428 *Yamamiya, C. 1933. On the tsutsugamushi disease of the Pescadores. *Gundam Zasshi*, No. **238**: 525 (In Japanese).

Abstract of a presentation in which Yamamiya mentions studying 5 patients with fever, rash, lymphadenitis and eschar from the Pescadores. In at least one case, rickettsiae were isolated by injection of patient's blood into rabbit testes and carried through several such passages. "Red mites" were also taken from house rats and dogs. Therefore, the author considers that the unknown fever of the Pescadores is tsutsugamushi disease. In 1933, there were 16 cases of tsutsugamushi disease, with one death, recorded from the islands.

R472 *Morishita, K., H. Miyahara and H. Ishioka. 1933. On the *Rickettsia* isolated from tsutsugamushi patients in Formosa. *J. Formosan Med. Assoc.*, **32**(4): 593-594 (In Japanese).

Abstract of a presentation detailing the isolation of *Rickettsia tsutsugamushi* from a patient on Taiwan. The authors carried an isolate from human blood through 18 intraperitoneal mouse passages and found rickettsiae in smears of all organs but brain. They also passed the same material in rabbit testes through 6 passages. Although rickettsiae were demonstrated in smears, rabbits did not become ill. Morishita was hesitant to synonymize Japanese and Formosan strains because eschars were not always present in human cases of the latter and also because of the lower mortality in Formosa. Of interest was that the patient had been ill for 9 days at the time blood was drawn.

R523 Kawamura, R., Y. Imagawa and T. Ito. 1933. On the Weil-Felix reaction in tsutsugamushi disease. *Tokyo Iji Shinshi*, No. **2830**: 1255-1264 (In Japanese).

The authors studied the Weil-Felix reaction in sera from 11 healthy individuals, 38

stayed. To familiarize himself with known foci, he took a tour around the Island starting from Taipei to Suao, to Hualien, Taitung and then across the southern tip, returning via the West Coast visiting the Arisan (Ali-shan) line and Sun-moon Lake. While at Hualien he injected patient's blood into rabbit testes and upon his return to Japan identified rickettsiae from the testes, which he considered to be identical to the etiologic agent of tsutsugamushi disease in Japan. This may constitute the first documented confirmation of rickettsiae isolated from a human on Taiwan.

- R436 *Ko, T. 1931. The results of the studies on tsutsugamushi disease. *J. Formosan Med. Assoc.*, **30**(12): 1501-1502 (In Japanese).

Abstract of a meeting presentation in which the author describes his experience with 101 cases of scrub typhus during a 15 year period in Bantan (Wantan, Pingtung Hsien). A table lists the cases by year and month for 95 "reliable cases". Ages were from 1-76 years. Patients had rash for 5 to 13 days with an average of 8 days. Rash also occurred on the mucous membrane of the hard palate. Twenty patients died, some from complications which are not described. The author eliminated the cases with complications in arriving at a true mortality of about 15%. He also trapped 502 rats and found "red mites" on only 20.

- R432 Hara, Y. 1932. On the patho-histological changes of lymph gland in tsutsugamushi disease in Formosa. *J. Formosan Med. Assoc.*, **31**(2): 127-134 (In Japanese).

The author was a member of relief party following an aborigine revolt at Musha (Wu-she) in 1930. He removed lymph nodes from 5 patients with scrub typhus and examined them grossly and histologically. Nodes were from near eschar sites. Three were inguinal. There are no illustrations nor photomicrographs, and the author's descriptions are difficult to interpret. Plasma cells and multinucleated cells were rare.

- R502 Miyairi, K. 1932. Additional knowledge on haemogregarines of *Microtus*. *Tokyo Iji Shinshi*, No. **2785**: 1591-1595 (In Japanese).

The author, a retired Professor, reports on the complete life cycle of a haemogregarine which underwent alternation of generation between a species of *Microtus* and leeches or mites. He considered the pathology of a human lung described by Dr. Kawamura similar to the pathology of lungs of mice trapped in dangerous areas of Niigata Prefecture. Eight of 14 mice trapped from the above area were infected with haemogregarines. Consequently, he felt that the agent of scrub typhus in Japan was a haemogregarine. He recognized the affinities of his organisms with coccidia including *Hepatozoon*.

- R503 Miyairi, K. 1932. Exhibition of the specimens of haemogregarines from *Microtus*. *Tokyo Iji Shinshi*, No. **2805**: 2803-2807, Fig. 1 (In Japanese).

Miyairi continues to reinforce his opinion that haemogregarines are the causative agent of tsutsugamushi disease even though he was aware of *Rickettsia*. However, he did not

patients with various diseases including TB and syphilis, and in 47 patients with acute or prior scrub typhus infection. All were Japanese except one scrub typhus patient from Formosa. Table 1 gives results from the healthy individuals. Reactions of the H and O variants of *Proteus* X19 and X2 were completely negative except for one HX19 with a 1:50 titer. The H and OXK reactions were all 1:100 or less, and 2 were completely negative. In patients with various disease, the highest titer was an OXK of 1:400 in a patient with epididymitis. Although there were many positive XK reactions, except for that one patient, they were all 1:200 or less. Table 3 lists only 44 cases, not 47 acute or prior scrub typhus cases as stated in the text. Of this group, the patient from Formosa had completely negative tests even after 14 days of illness. In other patients, the XK, particularly the OXK, was usually high. However, the author states that 41.3% of these acute patients had titers of 1:800 or greater, but we could only count 14 from the table for a percentage of 31.8. Three of the scrub typhus cases other than the one from Formosa were completely negative, and the authors conclude this was because the patients were tested too shortly after onset or too long (more than 2 years) after acquisition of the disease. In experimentally-infected rabbits, monkeys and guinea pigs an OXK titer of up to 1:400 was observed. There is an appendix giving Weil-Felix reactions in several animals, including man and a donkey, that were infected with manchurian (murine) typhus. The authors discuss regional differences in the Weil-Felix reaction for scrub typhus. Thus, in Indonesia, as in Japan, the OXK titers are high; but in the Malay Peninsula they are low.

- R437 *Naritomi, C. 1933. On the peculiar symptoms found in the rabbit inoculated by way of preocular cavity with blood of the patient of an unknown fever from the Pescadores, and the *Rickettsia orientalis* observed in the endothelial cells of cornea. (Preliminary report). *J. Formosan Med. Assoc.*, 32(9): 1291-1292 (In Japanese with German summary).

A manuscript published posthumously since the author died possibly of scrub typhus before its acceptance. Since his mother wished it published, the paper was accepted without changes by Professor Mogi of Taihoku Imperial University (National Taiwan University). The geography and environmental features of the Pescadores are briefly described and comments made on the epidemiology of the hitherto "unknown fever" of the Pescadores, which averages 10 cases a year. The author apparently felt he was the first, in September 1932, to prove that the unknown fevers of the Pescadores were in fact tsutsugamushi disease. He isolated rickettsiae from blood of a patient by inoculation into the preocular cavity of rabbits. Endothelial cells of the cornea were removed and the numerous biglobular, rod-shaped organisms, seen after Giemsa staining, considered to be *Rickettsia orientalis*. This and Naritomi's previous paper of 1932 apparently constitute the first recognition of scrub typhus in the Pescadores Islands.

- R431 *Yamamiya, C. and S. Honda. 1933. Observations on the tsutsugamushi disease of the Pescadores. *J. Formosan Med. Assoc.*, 32(12): 1803-1804 (In Japanese).

Abstract of a presentation in which Yamamiya, a physician in the prefectural civilian hospital in Makung, and Honda, a military physician, collaborate on their 2 year's experi-

ence with scrub typhus. Both men recognized that the disease was highly prevalent and correlated with temperature and rainfall. They felt the latter was particularly important, noting that 36 years of rainfall records showed June, July and August to be the highest months and that tsutsugamushi disease occurred most frequently in July and August. In 1933, outbreaks only occurred in June and July which were also the months of highest rainfall. Along with weather, the flat, treeless environment of the islands was also considered to have influence on scrub typhus epidemiology. They isolated rickettsiae from both scrub typhus and two-week fever (murine typhus) cases and stated that there were morphological differences in the organisms. Murine typhus rickettsiae were longer and more rectangular.

- R438 ***Morishita, K., H. Miyahara and H. Ishioka.** 1933. Studies on the tsutsugamushi disease of Formosa, with a special reference to the diagnosis of the causative agent of the disease. *J. Formosan Med. Assoc.*, **32**(12):1804-1805 (In Japanese).

Abstract of a meeting presentation. The authors achieved primary isolation of rickettsiae by inoculation of the blood from 5 patients into laboratory mice which then demonstrated rickettsiae after 9 days. Up to 10 mouse passages were accomplished. Isolations were from patients between 6 and 21 days after onsets of illnesses. Although most numerous in the abdominal membrane, organisms were also seen in liver and lung, and also recognizable in spleen, kidney and testes of mice. There was no testes reaction in rabbits and it was not possible to demonstrate organisms, but persistence could be demonstrated by inoculating rabbit testes emulsions back into laboratory mice. Although ocular symptoms were present, no rickettsiae could be demonstrated by inoculation into the pre-ocular cavity of rabbits. Inability to demonstrate rickettsiae in rabbits was thought to be due to weaker virulence of the Formosan strain.

- R439 ***Yamamiya, T.** 1933. The tsutsugamushi disease of the Pescadores, as determined by Weil-Felix reaction, and its relationship with spotted fever. *J. Formosan Med. Assoc.*, **32**(12):1808 (In Japanese).

Abstract of a presentation in which the author obtained strains of *Proteus* OXK, OX2 and OX19 from Dr. Kawamura, testing the sera of 17 suspected scrub typhus cases from the Pescadores. Titers were usually about 1 to 800 and considered lower than found in Japanese cases, but higher than in Malayan cases. Eschar and lymphadenopathy were always present in the Pescadores, as opposed to the occurrence of atypical cases, i.e., those without eschar, on Formosa proper. The author differentiated tsutsugamushi disease from sporadic spotted fever (two-weeks fever, murine typhus) since 8 of the latter were encountered that only had high OX19 titers. He never encountered elevated titers to the OX2 strain.

An addendum of a brief discussion by Dr. K. Morishita is included. He stated that on Formosa tsutsugamushi disease and two-weeks fever could be differentiated by the morphology of the respective rickettsiae.

- R531 *Akashi, K., T. Yoshimura and H. Yo. 1933. On Weil-Felix reaction with sporadic spotted fever. *J. Formosan Med. Assoc.*, **32**(12): 1808-1809 (In Japanese).

Abstract of a meeting presentation in which the authors, physicians from a Tainan hospital, analyzed sera of 14 patients admitted for sporadic spotted fever (murine typhus) by the Weil-Felix test. Nine cases reacted to X19, 3 to X2 and 2 to XK. The test strains included both O and H type variants. The authors were not certain if the 2 OXK agglutinations were false positives or indicated a concurrent infection of atypical tsutsugamushi disease, i.e., tsutsugamushi disease without eschar and lymphadenitis. In response to a question from K. Karauchi who mentioned that Manchurian typhus also reacts to OX19, the authors recognize that two-weeks fever of Formosa is the same as that disease. However, no explanation is given to Karauchi's question regarding clinical differences between OX19 and OX2 cases.

Morishita, K. 1933. Tsutsugamushi disease of Formosa. *Taiwan Jiho* 168 (In Japanese).

Not seen.

- R384 Kawamura, R., Y. Imagawa and T. Ito. 1934. The tsutsugamushi disease of Formosa as observed by Weil-Felix reaction and the similar spotted fever. *Tokyo Iji Shinshi*, No. 2864: 303-308 (In Japanese).

The authors, based in Japan, analyzed human sera from Taiwan and the Pescadores Islands by Weil-Felix reaction to determine if the test is useful in differentiating tsutsugamushi disease and sporadic spotted fever (murine typhus). Their experience with the Weil-Felix reaction for tsutsugamushi patients in Japan (Table II) was that OXK titers were uniformly elevated; X2 and X19 never. Sera of 10 scrub typhus patients from Taiwan and 8 from the Pescadores I., were analyzed. One case from the Pescadores Islands had an elevated OX19 titer (1:100), but most others, and this one, had elevated OXK titers, though not nearly as high as for Japanese cases (maximum of 1:800 versus 1:6000). These results were interpreted as showing the Pescadores strains to be milder than those of Japan. An additional 6 sera drawn from patients diagnosed as sporadic spotted fever (murine typhus) from the Pescadores Islands were tested. These patients had neither an eschar nor lymphadenitis. All had high OX19 titers which were interpreted as indicating the Weil-Felix reaction can be useful in differentiating the 2 diseases in Formosa. The authors concluded that the Weil-Felix reaction was variable for tsutsugamushi disease producing high XK titers in Japan and Sumatra and low titers in Formosa and Malaya.

- R505 *Morishita, K. 1934. Distribution of tsutsugamushi disease in Formosa and its outbreaks. *J. Formosan Med. Assoc.*, **33**(3): 549-551 (In Japanese).

Abstract of a meeting presentation which is basically a summary of the author's long monograph on the distribution and prevalence of tsutsugamushi disease published in the

same year. He mainly emphasizes geographical distribution of human cases, and states the disease was first recognized among Japanese police in 1908 but does not say who discovered it. All prefectures had reported cases and he points out areas among them with highest morbidity. An outbreak in 1930 among some aborigines fleeing security forces, as well as amongst Japanese construction workers near Sun-moon-lake in present day Nantou Hsien, is mentioned. In another outbreak in 1932, there were 163 cases, mostly among Japanese power plant workers in Taichu Prefecture (Nantou Hsien). Of the 3 principal races, more cases occurred among Japanese. In 1916, there were 576 Japanese cases, 436 Chinese cases, but only 7 aborigine cases. Although most disease was in young adult males, a surprisingly good number of cases occurred in children of age group 1-5 (authors words). This age group experienced a mortality of only 3.4% whereas those over 60 had 45% mortality. Overall mortality was 10.6%. A list of 6 chigger species known from Formosa is included.

- R446 **Morishita, K.** 1934. The distribution and prevalence of tsutsugamushi disease in Formosa. *Contributions from the Department of Hygiene, Government Research Inst., Formosa*, No. 216: 79 pp.+ photos and map (In Japanese).

A particularly important monographic treatment of human epidemiology of scrub typhus in Taiwan. Morishita reviews the history of scrub typhus outbreaks, starting from 1908, when cases were first recognized during the construction of a security outpost near Karenko (Hualien), up to 1934, including brief comments on nearly all papers relating to scrub typhus in Taiwan published to that date. He presents especially valuable summaries of human cases during the years 1923-32, giving written and tabular accounts by year, prefecture, seasonal prevalence, race, sex and age. Between 1923 and 1932, 878 cases with 93 deaths occurred resulting in a mortality of 10.6%. Most cases occurred from May through October with some throughout the entire year in southern Taiwan. Peak prevalence was in July and September. Of 1,024 cases reported since 1916, 576 were Japanese, 436 Formosan Chinese, 7 Aborigines and 5 other Chinese. In 984 of these cases for which ages were known, the majority fell in age group 26-30; males outnumbered females (691 versus 293). Japanese constituted the largest portion of this number with 554 cases (414 males and 140 females) followed by 430 Formosan Chinese (279 males and 151 females). He also summarizes the known chigger species of Taiwan and comments on their distribution and hosts. He follows Miyajima and Okumura in considering Hatori's *Trombicula pseudo-akamushi* to be *T. mediocris* Berlese. Hatori's travels with Walch in the Austro-malaysian Region where they encountered a chigger species near to Hatori's *T. pseudo-akamushi* and named *T. pseudo-akamushi* var. *deliensis* are mentioned. A brief list of the known hosts of the tsutsugamushi (*T. akamushi*), without comment, is given. With the exception of a few papers, an accurate bibliography of all articles relating to scrub typhus in Taiwan up to 1934 is included. The author of this paper was a longtime Professor of Medical Zoology at National Taiwan University (= Taihoku Imperial University) and had a distinguished career including many diverse publications ranging from scrub typhus to taxonomy of anophelines of Taiwan.

- R475 **Ko, T.** 1934. Clinical observation on one hundred cases of tsutsugamushi disease. *J. Formosan Med. Assoc.*, **33**(4): 591-594 (In Japanese with German summary).

A Taiwanese physician summarizes his findings on more than 100 cases of scrub typhus from the coastal plain of Heito Prefecture (Pingtung Hsien, Southern Taiwan) from 1917 to 1930. Most were among farming households with onsets occurring throughout the year: Jan. (10), Feb. (3), Mar. (3), April (6), May (9), June (11), July (11), Aug. (12), Sept. (10), Oct. (12), Nov. (6), Dec. (3). The majority of cases fell between 15-30 years of age, although one 16 month old and one 76 year old were seen. Males outnumbered females, 56 versus 44. The incubation period ranged from 4-12 days with an average of 7. Early signs and symptoms, as well as the most commonly expected, are given. Except for one unknown case, all had eschars. The location and frequency of each site are listed; eschars were common in the genital area. One death was associated with subcutaneous hemorrhage. Fever usually lasted 2-3 weeks. The "Diazo" reaction was often observed. The mortality rate was 20% but none in patients under 15 years of age.

- R532 ***Kyu, U. F.** 1934. Studies on the *Rickettsia*, the etiologic agent of the so-called two-weeks fever in Formosa. *J. Formosan Med. Assoc.*, **33**(10): 1836-1838 (In Japanese).

Abstract from a meeting which is concerned with murine, not scrub typhus. The author trapped 34 rats, 8 *Rattus rattus* and 26 *R. norvegicus*, and inoculated brain suspensions into the testes or peritoneum of guinea pigs. A pool each of 3 house rats and 2 Norway rats were positive by elevated fevers and demonstration of *Rickettsia* in the testes. Fleas were examined by Giemsa staining of guts, and 2 of 32 *Xenopsylla cheopis* specimens were found positive. Positive guinea pigs were also obtained by inoculation of pooled flea stomach being retained for Giemsa staining. Only guinea pigs receiving stomachs which were *Rickettsia* positive by Giemsa stain became infected. Wild fleas from low incidence areas were fed on clean white rats, then transferred to infected Norway rats. After 5 days of feeding, rickettsiae were found in flea stomach smears. Uninfected *cheopis* fleas were fed on infected white rats and the stomachs examined daily; rickettsiae were detected on the fourth day of feeding and found in mass by the 20th day. *Ctenocephalus felis* (*Ctenocephalides felis*) was not infected in nature but could experimentally transmit the disease. An addendum by C. Yamamiya asks several questions. Kyu replies to the one on serial syringe passage of blood versus passage of brain suspension by saying the former was not efficient.

- R533 ***Yamamiya, C.** 1934. On the tsutsugamushi disease in the Pescadores, with a special reference to its distribution and epidemiology and naturally infected animals. *J. Formosan Med. Assoc.*, **33**(12): 1838 (In Japanese).

The author, a Japanese government physician stationed in the Pescadores, has investigated more than 50 cases of scrub typhus from 1931-1934. From June to October of 1934 he trapped more than 200 rodents and shrews. "Akamushi" were seen on all trapped animals and on dogs and cats. *Rattus rattus rufescens* had the highest infestation followed by *Mus musculus*, *R. norvegicus* and *Suncus murinus*. Based on appearance of

the spleen (dark red and swollen), *R. rattus rufescens* had the highest rickettsial infection rate. Attempted isolation from 12 *R. rattus rufescens* with enlarged spleens yielded 5 positives. Isolation was probably by mouse inoculation. Prof. K. Morishita added a comment after this presentation that he feels the Taiwan and Pescadores strains are identical. The experimental animal work by Yamamiya and coworkers with the Pescadores strain almost exactly agree with his results on the Formosan strain. This paper represents the first documentation of the isolation of *Rickettsia tsutsugamushi* from a wild rodent host in the Pescadores Islands.

- R481 **Kawamura, R., Y. Imagawa and T. Ito.** 1935. The Weil-Felix reaction in tsutsugamushi disease and its relation to endemic typhus in Manchuko and Formosa. *Kitasato Arch. Exper. Med.*, 12(1):26-57 (In English).

This paper is the combined English version of the authors' previous papers of 1933 and 1934. The introductory comments on the history of the various *Proteus* strains used in the diagnosis of scrub and murine typhus were expanded and the authors mention obtaining their cultures from Dr. Felix. Titers of OXK up to 1:100 were encountered in 11 healthy Japanese and to 1:400 in 38 patients with diseases other than typhus.

In 49 cases of tsutsugamushi disease from Japan, OXK titers were high after 14 days of illness, with titers in the thousands. An additional 5 cases, not included in their data of 1933, are added to table 3 of this paper. Eighteen sera from Formosan and Boko (Pescadores Islands) patients were examined. Usually, titers were much lower than found in the Japanese, and this could not always be accounted for because of short duration of illness. Various animals were experimentally infected with scrub typhus rickettsiae, and, except for weak OXK reactions in some, results were unremarkable. Infection of domestic animals with murine typhus produced remarkably high titers, particularly homologous. Six sera of endemic (murine) typhus patients from the Boko Islands (Pescadores I.) showed high titers against OX19 except when the duration of illness had been short. The authors concluded that scrub typhus in the Pescadores Islands produced lower OXK titers than did illness in Japan, and that on Formosa proper titers were even less. They also pointed out that this was just one way in which the Japanese and Formosan diseases differed. Other differences included case fatality ratios, presence of eschar, and rash. Coexistence of murine and scrub typhus, as occurred in the Pescadores Islands, had previously been reported from Malaya (by Fletcher) and Indonesia.

- R473 **Morishita, K., H. Ishioka, and H. Miyahara.** 1935. Studies on the tsutsugamushi disease in Formosa with a special reference to its causative agent. I. The *Rickettsia* isolated from patients, and its behavior in experimental animals. *Saikingaku Zasshi*, No. 469: 171-195, photos. 1-3 (In Japanese).

A large experimental paper, involving inoculation of rabbits, guinea pigs, and mice with blood of patients from Taipei (3 cases), Hualien (1), Taichung (11), and Kaohsiung (1). Rabbits were infected by injection into testes; results were not dramatic, but infection was confirmed by passage of testicular material in mice. Attempts to infect rabbits by infection into the pre-ocular cavity were unsuccessful. Guinea pigs were generally refractory

by inoculation via the testes; however, infection could be confirmed by passage of testicular material into mice. By intraperitoneal inoculation, it was possible, in guinea pigs killed 6 days after inoculation, to demonstrate rickettsiae in the peritoneal membrane and testes. Intraperitoneal inoculation of mice with human blood resulted in demonstration of the rickettsiae in 9-13 days. A total of 15-37 mouse passages was possible and led to increased virulence. After long serial passage, mice died in 6-10 days (4 days the earliest). No strain differences were noted. They conclude that experimental results were different than might have been expected with strains from Japan and indicate a local strain variation for Formosa.

- R392 **Yamamiya, C.** 1935. On the tsutsugamushi disease of the Pescadores. *Saikingaku Zasshi*, No. 469: 196-219 (In Japanese).

In his introductory chapter, the author, a physician working in the Pescadores Islands, reviews the distribution of the disease in Sumatra, Vietnam, Philippines and Malaysia. He then briefly describes the geography, hygienic status, customs and habits of the Pescadores Islands and its inhabitants, and also includes weather data tables for temperature, rainfall and wind velocity from 1927-1931. Chapter II contains detailed case histories for 18 of 32 patients he examined between June 1931 to Oct. 1933. Only 6 were local inhabitants. A long sequel paper containing chapters III-X will describe epidemiology, serology, animal inoculation, and comparison with the disease in Japan and Taiwan.

- R455 **Yamamiya, C.** 1935. On the tsutsugamushi disease of the Pescadores (continuation). *Saikingaku Zasshi*. No. 470: 257-284, Photos 1-8 (In Japanese).

This is the second part of the preceding article in which Yamamiya continues with case histories 1 through 32. All had eschars, and one died. She was a 1 year old female. Chapter 3 summarizes the usual clinical findings which included progressive increase of body temperature, fever lasting 10 to 18 days, in one case lasting 30 days, and rash for 4-5 days subsiding by the 9th day. Generalized lymphadenopathy was an important diagnostic finding. There was no urine urobilin, but urobilinogen was present in all cases. The Weil-Felix reaction was negative against OX19, but positive against OXK. WBC usually were in the range of 4000-5000 with lymphocytosis, neutropenia and eosinopenia. Splenomegaly and hepatomegaly were not constant. Chapter 4 describes epidemiology with particular reference to season and weather. Red mites found in ear lobes of *Suncus murinus*, *Rattus rattus*, *Mus musculus*, dogs, and combs of chickens, were identified as *Trombicula akamushi*. The chiggers are described in detail and fit the present day definition of *Leptotrombidium deliense*. In one family, there were 3 cases, including 2 infants, and the family dog had red mites. Adult mites were recovered but the author does not discuss them.

Chapter 5 discusses Weil-Felix reactions which were positive up to serum dilutions of 1:1600 against OXK, particularly after 10 days of illness. Most titers only reacted up to dilutions of 1:800. Positive tests persisted for up to 2 years. By contrast, sera from cases of sporadic spotted fever (murine typhus), had predominately elevated OX19 titers. Sera from 15 healthy individuals and 7 others with various conditions were used as con-

trols, and in these OXK was negative or of low titer. Experimentally infected lab animals were also tested by Weil-Felix after 8 days and found to have OXK or OX19 antibodies depending on whether the inoculum was scrub or murine typhus, respectively. Chapter 6 describes isolation of the organism after passage in rabbit testes or intraperitoneal inoculation of mice and guinea pigs. For the latter two, organisms were best seen after 2 passages. There is no comment as to whether guinea pigs were successfully inoculated. Chapter 7 compares the Pescadores disease with that elsewhere in Southeast Asia, and the author concludes all are tsutsugamushi with some differences such as mortality, presence or absence of eschar, Weil-Felix titers and lymph swelling. Chapter 8 gives diagnostic criteria and Chapter 9 discusses treatment. Treatment mainly was supportive but serum therapy was tried, without success. The author felt immunity was present after natural infection since no re-infected cases had been seen. Chapter 10 lists conclusions. There are 67 references and 8 photos. Interestingly, one figure presumably shows rickettsiae in the liver of a guinea pig.

- R434 *Yamamiya, C. 1935. On the tsutsugamushi disease of the Pescadores (Further report). *J. Formosan Med. Assoc.*, **34**: 2164 (In Japanese).

Abstract of a presentation in which the author summarizes observations on about 100 cases (2 deaths) seen during a 5 year period from 1931-1935. Children below 10 years of age constituted 50% of the cases, and even babies were occasionally infected. Clustering of cases within families was not uncommon. He considered *Rattus rattus rufescens* to be the primary host animal but did not feel the difference in virulence between Japan and the Pescadores due to different hosts. The only vector, "red mite", in the Pescadores was true *Trombicula akamushi* of the fine hair type. The abundance of *akamushi* (*deliense*) on rodents was lower in the winter. He discusses the soil of the Pescadores, including mineral content, and states it is neutral or weakly acid which is believed beneficial for chigger development as reported by workers in Japan.

- R537 *Sotoma, T. 1936. 1. Experimental studies on the immunity of tsutsugamushi disease of the Pescadores. (Preliminary Report). In: Mako Seminar (31 October 1935). *Japan. Navy Med. J.*, **25**: 205-286 (In Japanese).

Abstract of a presentation to a seminar on scrub typhus held in Mako (Makung), Pescadores Islands. The author mentions passing rickettsiae by intraperitoneal injection through 25 generations of mice to study the presence or absence of immunity. He also inoculated rickettsiae into the preocular cavity, testis and peritoneal cavity of rabbits. No results of his experiments are given. All participants in this seminar appear to be staff members of the Formosan Government Hospital in Mako (Makung).

- R537 *Nakamura, R. 1936. 2. On the soil of the Pescadores. In: Mako Seminar (31 October 1935). *Japan. Navy Med. J.*, **25**: 205-206 (In Japanese).

Abstract of a presentation to a seminar on scrub typhus held in Mako (Makung), Pescadores Islands. The author tested the pH of the soil at 20 sites by the potassium

chloride method and found it to be neutral to weakly alkaline, ranging from 7 to 7.3. An explanation of the potassium chloride test is included.

- R537 *Umemoto, B. 1936. 3. On the red cell sedimentation rate in patients of tsutsugamushi disease in the Pescadores. In: Mako Seminar (31 October 1935). *Japan. Navy Med. J.*, 25: 205-206 (In Japanese).

Abstract of a presentation to a seminar on scrub typhus held in Mako (Makung), Pescadores Islands. The author indicates that the red cell sedimentation rate generally increases, reaching a maximum rate at the "crisis" of the disease. An increased rate continues to occur until some time after the fever has subsided. He concludes that the sedimentation rate has little value in diagnosis and prognosis of the disease.

- R537 *Yamamiya, C. 1936. 4. On the tsutsugamushi disease of the Pescadores. In: Mako Seminar (31 October 1931). *Japan. Navy Med. J.*, 25: 205-206 (In Japanese).

Abstract of a presentation to a seminar on a scrub typhus held in Mako (Makung), Pescadores Islands. This presentation is identical to the one which Yamamiya gave to the annual meeting of the Formosan Medical Association and which appeared the previous year (1935) in volume 34 of the *J. Formosan Med. Assoc.*

- R477 Sugimoto, M. 1936. On the Formosan chicken mite, *Neoschöngastia gallinarum*. (Hatori, 1920). *J. Jap. Soc. Vet. Sci.*, 15(3): 201-213, pls. I-III (In Japanese with captions for figures in English).

This paper, submitted in July 1936, was resubmitted again by Sugimoto the following month to appear in the *J. Soc. Trop. Agric. Formosa*, 8(8): 241-253. With the exception of a few words, lack of an English summary, and an additional plate, it is identical to the other article. The extra plate contains a rather poor photomicrograph of a larva and adult. See other article for the annotation.

- R476 *Sugimoto, M. 1936. On the Formosan chicken mite, *Neoschöngastia gallinarum* (Hatori, 1920) (I). *J. Soc. Trop. Agric. Formosa*, 8(8): 241-253, pls. I & II (In Japanese with English summary).

Although the title implies a study of only *Neoschöngastia gallinarum*, the author also gives a brief account of all known trombiculids, "red mites", that parasitize birds. In Chapter I he discusses the medical and veterinary importance of chiggers in general and points out that the loss of and injury to chickens due to parasitism by red mites in Formosa has been largely unrecognized. Chapter 2 is a list of the Formosan bird chiggers and their hosts. He also relates his experience with the Formosan chicken mite and explains his reason for transferring *gallinarum* from the genus *Trombicula* to the genus *Neoschöngastia*. Chapter 3 lists all the chiggers that have been reported to parasitize birds elsewhere than Formosa. A brief commentary on each species with their known hosts is included.

Chapter 4 gives a provisional description and measurements of a presumed adult of *N. gallinarum*, along with a redescription of the larva. The former was based on a single adult mite collected from soil where larvae were present. Numerous collection records of his own and previous authors for *N. gallinarum* on Taiwan are presented in Chapter 5. Chapter 6 is largely a discussion of the economic and medical importance of "red mites" that infest chickens with comments about habitats favorable to their growth, injury to chickens and his own observations of *N. gallinarum* in particular. Treatment of ulcers, prevention of infestation and area control are given in Chapter 7. He strongly recommends confinement of chickens during the hot summer months until they reach young adult size. No where in the Japanese text does he mention examining any of Hatori's original type material. However, in the English summary, he states the type and 19 paratypes are in the Taihoku Imperial University Museum, Taihoku, Taiwan (National Taiwan University, Taipei, Taiwan). This article was also published concurrently by Sugimoto in the *J. Jap. Soc. Vet. Sci.*, 15(3):201-213.

- R451 *Kawamura, R., T. Ito, R. Nakamura, T. Kamimura and I. Sato. 1937. On the prevention of tsutsugamushi disease (1st report). *Tokyo Iji Shinshi*, No. 3021:505-517 (In Japanese).

This paper, published in February 1937, gives almost identical information as an English version published in May of the same year in *Kitasato Archives of Experimental Medicine*, 14(2):75-98. A complete translation of this article is available. See English version for the annotation.

- R141 Kawamura, R., T. Ito, R. Nakamura, T. Kamimura and I. Sato. 1937. On prevention of tsutsugamushi disease including new method of fever therapy. *Kitasato Arch. Exper. Med.*, 14(2):75-98 (In English).

A report of a vaccination trial to test the degree of immunity conferred by inoculation of a weakly virulent strain of *Rickettsia tsutsugamushi* from the Pescadores Islands followed by the more virulent Niigata strain from Japan. The majority of 22 individuals with mental disease were injected subcutaneously with a saline emulsion of rabbit testes; 2 were inoculated intravenously and 1 subcutaneously with blood taken from febrile cases. The Pescadores strain of scrub typhus originated in 1935 from a patient at the government hospital and had been carried through 79 mouse and rabbit intraperitoneal passages. The Pescadores strain produced a local skin reaction, mild fever and regional lymphadenopathy. Eighteen developed rash and 8 showed signs of splenomegaly.

Eight days after fever subsided, 20 of the patients were then given rabbit testicle emulsion of the Niigata strain. All 20 had experienced a rickettssemia with the Pescadores strain but only 6 could be noted with the Niigata strain. Clinical symptoms were mild or nearly absent in all. Four patients had slight fever but the remaining 16 had no symptoms.

A weakness of this trial, which the authors acknowledge, is that there was no control human group inoculated with only the Niigata strain. Presumably this would have caused serious illness. Also, the interval between vaccination and trial was very short.

Animal experiments were also conducted in which rabbits were given inoculations of the Pescadores and Niigata strains. Immunity was demonstrated in those animals in which the interval between inoculations was not more than 6 months. The virulence of the 2 strains in mice differed markedly, with Niigata strain causing many more deaths.

- R484 **Miyairi, K.** 1937. The so-called hypopharynx of tsutsugamushi. *Tokyo Iji Shinshi*, No. 3024: 743-747 (In Japanese).

The so-called hypopharynx referred to in this paper is known by present terminology as the stylostome. Miyairi observed the structure in sections cut from rat ears and stained in haematoxylin and eosin. About 1000 rats were obtained from Horin (Fenglin) in Karenko Prefecture (Hualien Hsien) and about 300 mice from Niigata Prefecture in Japan. Histological sections were of attached chiggers on cut-off ears or of ears from animals held alive until chiggers detached. He did not consider the "hypopharynx" to be a specialized retractile organ as reported by a German author nor a structure formed by host tissue reaction, but a feeding tube produced by the mite. The length of the structure varied, and was observed to be inserted much deeper in Formosan rats than in mice from Japan. He also reported seeing haemogregarines within the tube. This observation appropriately coincided with his erroneous theory that haemogregarines rather than rickettsiae caused tsutsugamushi disease.

- R514 ***Sugimoto, M.** 1938. Formosan Trombidid larvae, Part II. With description of a new species. *J. Soc. Trop. Agric., Formosa*, 10: 94-98, figs. 1-4 (In Japanese with English summary).

Sugimoto's description of *Trombicula isshikii*, n. sp., from *Capella hardwickii* also includes a comparison with Hatori's *T. pseudoakamushi* and *T. corvi*. The English summary omits the comparative remarks but is otherwise a fairly complete translation of the descriptive section. Sugimoto submitted and published this article in 2 different journals in 1938. Although authors have always cited this article by Sugimoto's English title, the actual Japanese title which appears immediately above the English title reads: "Studies on the red mites parasitic on fowls of Formosa (II). On *Trombicula isshikii* n. sp., parasitic on Latham's snipe." This species was subsequently placed in the genus *Eutrombicula*.

- R534 **Sugimoto, M.** 1938. Studies on the red mites parasitic on fowls of Formosa (II). On *Trombicula isshikii*, n. sp., parasitic on Latham's snipe. *J. Jap. Soc. Vet. Sci.*, 17(1): 58-62, 1 pl. (In Japanese with English summary on pp. 6-7).

This article is same as that published by Sugimoto under the English title "Formosan Trombidid larvae, Part II. With description of a new species" in the *J. Soc. Trop. Agriculture, Formosa*, 10: 94-98, 1938. He concurrently published it in 2 different journals. The English summary is not continuous with the Japanese but otherwise is identical to the English summary which appeared in the other journal.

- R040 **Morishita, K.** 1938. On some parasitological interests in Formosa, with special reference to *Trypanosoma conorhini* and tsutsugamushi disease. *Rev. Medico-cirurgica do Brazil*, 2, s, 46(2): 225-232 (In English).

At an international meeting in Brasil, the author briefly sketches the diseases of parasitic importance in Formosa followed by reviews of his research on *Trypanosoma conorhini* and tsutsugamushi disease. The review on tsutsugamushi disease is a rather cursory summary of his 1934 and 1939 papers in Japanese. In his review of work with *T. conorhini* in *Triatoma rubrofasciata* he states that mice immunized with this trypanosome were not protected against subsequent infection with *Schizotrypanum cruzi*. Of other interest is his statement on p. 226 that spirochaetoses, including Weil's disease, were uncommon in Formosa.

- R478 ***Kawamura, R., S. Kasahara, T. Toyama, F. Nishinarita and S. Tsubaki.** 1938. On the prevention of tsutsugamushi disease (2nd report). Results of preventive inoculations for people in the endemic regions and laboratory tests with the Pescadores strain. *Tokyo Iji Shinshi*, No. 3115: 3323-3336 (In Japanese).

This paper forms a companion to the first report of experimental human infection with the Pescadores scrub typhus strain published by Kawamura et al. in 1937 in both Japanese and English. Basically, 31 healthy volunteers were inoculated in March with Pescadores strain rickettsiae and the resultant disease closely monitored. The volunteers then spent the summer in a known highly endemic scrub typhus focus in Niigata, Japan. None developed scrub typhus, presumably proving that the experimental infection protected. Chapter 1 gives methodology. The inoculum was rickettsiae isolated from a 44 year old male in the Pescadores which had been carried through 181 rabbit testis passages, emulsified in Ringer's solution, and administered in the right thigh at doses up to 1 ml. Volunteers were 20 males and 11 females from Ogata, one of whom had had scrub typhus 11 years previously. In a table, the lowest age given is 5, but this is a missprint—the text gives 12 as the youngest. Chapter 2 describes illness produced by the inoculation. There was transient local pain followed 3-4 days later by erythema and induration. After 6 to 9 days incubation period, all but the immune volunteer became ill, to a maximum of 2 weeks. Only 2 cases had to be confined for several days, the others went about their daily tasks. Table 4 lists signs and symptoms, which included fever to 40.5°C, chills, headache, generalized malaise and loss of appetite. All had some rash, even the immune volunteer. Hepatomegaly to 4 finger breadths occurred in 29, and splenomegaly in 15. Leucopenia was most intense at the time of rash, with decrease in polymorphonuclear cells and eosinophils. Lymphocytes rose to 70 percent, and plasma cells appeared. This was preceded by eosinophilia, presumably a reaction to the foreign protein inoculum. Mild proteinuria developed in most cases. The immune volunteer, aged 54, was carefully followed. He had only transient signs and symptoms, and was able to carry out his normal duties as mayor. Blood was drawn from all cases. 0.5 ml of heparinized blood was diluted to 1-1000 and stored at room temperature for 2-3 days before injection into mice. Remarkably, rickettsiae were recovered from 22 of the cases, but never on the first mouse passage. The authors apparently had previously experienced difficulty in isolating Pesca-

dores rickettsiae without several mouse passages. Five other volunteers received only rabbit testes emulsion without rickettsiae. These controls experienced transient localized reactions which lasted only 2 days. Chapter 3 describes the followup of these patients in October after they had been exposed by working in fields during the summer. In the first paper of this series, one patient had been experimentally challenged with virulent Niigata rickettsiae 3 months after the Pescadores "immunization" without developing illness. In the present paper, exposure was natural; 4 volunteers reported chigger bites and 21 were presumably continuously exposed in their fields during the summer. None became ill with scrub typhus, whereas there were 2 or 3 cases in less-exposed, indigenous people tilling nearby fields.

The authors also conducted protection experiments in mice. Previously, they had noted that the Niigata strain was much more mouse-virulent than the Pescadores strain, and 32 days later all survivors withstood challenge with the Niigata strain. In another experiment, 50 mice were similarly handled, and 38 survived Niigata strain challenge. In Chapter 4, the authors discuss the merits of immunization with the Pescadores strain, and make suggestions for future improvements. They considered immunization practical because a total of 111 individuals had been infected with the Pescadores strain in their own and other laboratories without fatality or serious illness. They also conducted experiments on preservation of Pescadores rickettsiae at different temperatures, at various pHs, and in various media. Tyrode's solution was found to be the best medium, and preservation in the cold was most effective. Sections of testes preserved better than emulsions. They were able to preserve viable rickettsiae in testes sections in Tyrode's solution for up to 15 days at 3°C. Except for the tables, a complete translation of this paper is available.

- R515 Ueda, M. 1939. On the treatment of dementia paralytica with Pescadores strain of *tsutsugamushi* disease. *Tokyo Iji Shinshi*, No. 3121: 335-342 (In Japanese).

This paper describes the response of 20 syphilitics treated by Ueda with the Pescadores strain of *Rickettsia tsutsugamushi*. The author reviews the previous use of fever therapy for syphilis, which had included induced malaria and rickettsial spotted fever. Six females and 14 males, aged 17-46, were inoculated with 0.5 to 1.0 ml of emulsified rabbit testes. This was the 180th passage of *R. tsutsugamushi*, originally obtained from a 44 year old male from the Pescadores. Blood from patients thus inoculated was also used as inoculum, including, in one case, intravenous administration. Symptoms following experimental inoculation were much as encountered by Kawamura et al., with fever occurring after 2 to 10 (average 7) days. Rash occurred in most cases. Despite the fever, most patients felt well enough to play baseball.

Although not described in detail, the author claims since August 1938 to have passed these rickettsiae through 10 men by sequential blood injection. As little as 0.5 ml of whole blood was sufficient to cause subsequent rickettsemia. Complete improvement of syphilis resulted in 8 patients and incomplete improvement in 9. There was one death, attributable to causes other than injection of rickettsiae. The blood Wasserman test improved in 7 cases, and became negative in 2 of these. In the discussion and conclusions, the author lists advantages of this type fever therapy, viz, improvement in 40% of treated

cases, disease symptoms milder than with induced malaria. *Rickettsiae* are easily maintained and do not represent a public health hazard as might be the case with malaria, there are no relapses, and continuous passage from man to man is possible. This paper, published in February 1939, was republished again in September 1939 but authored by Kawamura and Ueda. The second printing, in English, presents the same data but in a more concise format. Four more references, for a total 18, were added.

- R001 **Kawamura, R. and C. Yamamiya.** 1939. On the tsutsugamushi disease in the Pescadores. *Kitasato Arch. Exper. Med.*, **16**(1): 79-91 (In English).

An English language paper which is essentially a summary of the detailed study by Yamamiya (*Saikingaku Zasshi*, 469-470, 1935) of 32 cases of scrub typhus in the Pescadores Islands from June 1931 to October 1933. Case history descriptions are limited to examples each of a mild, medium and severe case along with a general clinical picture of the disease and its epidemiology. Weil-Felix reactions for 16 cases are presented again. All 32 cases had eschars, most had rash and there was only one fatality. Credit for first recognition of the disease in the Pescadores I. is given to Yamamiya in 1931.

- R506 **Kawamura, R., S. Kasahara, T. Toyama, F. Nishinarita and S. Tsubaki.** 1939. On the prevention of tsutsugamushi disease. Results on the preventive inoculations for people in the endemic region, laboratory tests with the Pescadores strain. *Kitasato Archiv. Exper. Med.*, **16**(2): 93-109 (In English).

This paper, published in May 1939 is the English version of the original Japanese article published in December 1938 in *Tokyo Iji Shinshi*, No. **3115**: 3323-3336. It is somewhat shorter and more concise but essentially identical to the Japanese article. See Japanese article for the annotation.

- R070 **Morishita, K.** 1939. The tsutsugamushi disease in the Pescadores, with a special reference to its peculiar occurrence. *Tokyo Iji Shinshi*, No. **3144-45**: 1933-1939, 1 map, 6 photos (In Japanese).

An important paper, which coupled with Yamamiya's comprehensive reports (*Saikingaku Zasshi*, Nos. 469 and 470, 1935), gives the most complete account of the epidemiology of scrub typhus in the Pescadores Islands until the early 1960's. Morishita describes the islands, their weather and what he felt was the peculiar relationship of the houses to rodent breeding sites. More grass and vegetation is present along the coral walls surrounding vegetable gardens of households than in the open fields, thus the close proximity of houses to "noxious areas". The results of his study are summarized in 5 tables and one figure: Table 1 lists the number of cases by locality and by year from 1931-1938 for a total of 252 cases. Table 2 gives mortality rates by year. Table 3 gives prevalence by race and sex. For Chinese, there were 117 female cases and 120 male cases with a mortality just over 5%; only 15 cases occurred among Japanese with a mortality slightly more than 6%. Table 4 gives seasonal prevalence, all cases occurring from April to November, with most in June and July. Table 5 and Figure 2 give prevalence

and mortality by age group. Percent mortality was highest in the age group 50 and over. Figure 2 shows age breakdown for both Taiwan and Pescadores Islands by increments of 5 years. Seventy percent of the cases were in children 15 years of age and under: 1-5 (38.6%), followed by 6-11 (22.3%) and 11-15 (9.2%). Because of the immediate proximity of houses to endemic, "noxious" areas, he felt children became infected early in life while it was thought adults were mostly immune, hence the lower prevalence among those age groups. He states tsutsugamushi disease was first discovered in the Pescadores Islands in 1931 but probably existed before. The rodents encountered during his study were *Rattus rattus*, *R. norvegicus* and *Mus formosanus* (*M. musculus*). A complete translation of his summary is available.

- R482 **Kawamura, M.** and **M. Ueda.** 1939. On the treatment of general paresis with the Pescadores strain of tsutsugamushi virus. *Kitasato Archiv. Exper. Med.*, **16**(3):183-199 (In English).

This paper, published in September 1939, is a more concise English version of the original Japanese article first published by Ueda alone in February 1939 in *Tokyo Iji Shin-shi*, No. **3121**:335-342. There are fewer tables, and additional references. See article by Ueda for the annotation.

- R425 **Morishita, K.** 1939. Further notes on the epidemiology of tsutsugamushi disease in Formosa. *J. Formosan Med. Assoc.*, **38**(10):1471-1484 (In Japanese with English summary).

Morishita presents summaries of 166 cases by written and tabular accounts for the years 1933-1938. In the text and in Table 1 he extensively describes exact localities in Formosa where the disease occurred, dividing the information by outbreaks up to 1922, from 1923 to 1932, and from 1931 to 1938. Some new localities are added but most fall within known endemic areas. Tables 2 and 3 list cases by year and prefecture, exclusive of the Pescadores Islands, giving a prefectural summary and a breakdown by locality within each Prefecture. Overall annual incidence has decreased as compared with that of previous years. Seasonal prevalence, which has remained basically unchanged, is shown in Tables 4 and 5. Cases occurred throughout the year with fewest from February through April and others occurring chiefly from May through November, peaking in July. Table 6 gives occurrence by race and sex. Most cases were in male Japanese. The total sex ratio was 138 males to 28 females. Age group prevalence in Table 7 is given in 5-year increments. The highest number was in the 25-30 age group; other cases were mostly spread among ages 16 to 45. Table 8 gives mortality by sex and race and Table 9 by age. Most deaths were in those over 56. Exposure risk of males is certainly reflected in the last 3 tables.

- R535 ***Morishita, K.** 1940. Additional findings on the epidemiology and distribution of tsutsugamushi disease in Formosa, with special reference to its peculiarity in the Pescadores. *J. Formosan Med. Assoc.*, **39**(3):424-425 (In Japanese).

Abstract of a presentation which adds little that is not in his previous papers of 1934

and 1939. He points out that since scrub typhus became a reportable disease in the early 1930's, a gradual decrease has occurred in the number of cases per year on Taiwan during the period of 1935 to 1940. Whereas, in the Pescadores, there has been an annual increase in cases since 1931. New foci added to Taiwan were in eastern and southeastern areas of the island as well as a pocket in central Taiwan around Musha (Wu-she) and along Baikei (Mei-hsi) River in Nantou Hsien.

- R504 **Kawamura, R. and M. Ueda.** 1940. Eine neue therapie der dementia paralytica. (Zugleich eine prophylaxe gegen tsutsugamushi). *Klin. Wochenschr.*, **19**(27): 689-694 (In German).

This paper gives details of inoculation of 20 of a group of 22 psychiatric patients with Pescadores strain of *Rickettsia tsutsugamushi* and subsequent, immediate, challenge with Niigata strain organisms. Methods were the same as in Kawamura et al. (1937, 1938, 1939), Ueda (1939) and Kawamura and Ueda (1939). In fact these may be the same patients described in Kawamura et al. (1937). Between Ueda and Kawamura it is stated that 113 people were studied inclusive of this report. Thirty-one were Ueda patients, 31 were the healthy individuals described in Kawamura et al. (1938), 20 of 22 described in Kawamura et al. (1937) and perhaps here, if so, leaving 29 unaccounted for. Since this paper also redescribes experience with 31 healthy individuals of Kawamura et al. (1938), it is largely a summary of previously reported work.

- R447 **Kawahigasi, K.** 1941. Observations on the so-called irregular type of tsutsugamushi disease. *J. Formosan Med. Assoc.*, **40**(2): 355-367 (In Japanese with German summary).

The author, a Japanese physician in a regional hospital at Kagi (Chia-i), states in his introduction that Kawamura reported 100% occurrence of eschars in 90 cases of tsutsugamushi disease from Niigata Prefecture, while in Formosa the occurrence was variable, i.e., Hatori reported eschars in only 43 of 88 cases; contrary to this, Ko found 100% with eschars in a study of 100 cases, and in the Pescadores, Yamamiya found eschars in 100% of the cases from 1931-1933. In this paper, Kawahigasi reports on only 10 cases seen since 1938 but he considers 5, which were without eschars, to be atypical. He gives detailed case histories followed by summaries of the clinical differences between so-called atypical and typical cases. Differences, including Weil-Felix serologies, were unremarkable. Splenic enlargement was recognized in only 2 of the atypical cases. A table towards the end of the article summarizes findings from all 10 cases. He concludes that no differences could be noted between the 2 types.

- R448 **Kawahigasi, K.** 1942. An interesting case of tsutsugamushi disease. *J. Formosan Med. Assoc.*, **41**(1): 187-190 (In Japanese with German summary).

The case report of a 29 year old male with scrub typhus who presumably had more than 20 eschars. The Weil-Felix reaction was negative 8 days after onset of illness and 1:100 on the 20th day. An eschar appeared in the right armpit on the 11th day and by the 13th day there were more than 6 eschars and 20 "relics" under a poultice on the chest. The author believes he may have a record of 29 eschars in this patient, but ac-

knowledges that the ulcers on the chest might have been from itching. Ed. comment: or possibly from the poultice.

- R027 **Morishita, K.** 1942. Tsutsugamushi disease: Its epidemiology in Formosa. *Proc. 6th Pacific Sci. Congress. Berkeley*, 5: 639-647 (In English).

A review paper in English of epidemiology and history of scrub typhus with a section on the disease as it occurs in the Pescadores. Most of the data were presented previously in Morishita's 1934 and 1939 papers. He lists cases, morbidity, age and sex distribution of cases from 1923-1938 and discusses briefly Hatori's observations on chiggers and their hosts. The Boko Islands (Pescadores Islands) section emphasizes predilection for young children, and low mortality.

- R516 **Ueda, M.** 1942. On the treatment of dementia paralytica with Bokoto (Pescadores) strain of tsutsugamushi disease. 2nd Report. *Rinsho Igaku*, 29: 159-178 (In Japanese). 1)

This is a continuation of Ueda's 1939 paper and gives the results of his treatment of an additional 100 syphilitics with the Pescadores strain of *R. tsutsugamushi*. The inoculum was from the same 44 year old male which had now been carried through 300 rabbit testis passages. Patients ranged in age from 17 to 67. There were 82 males and 18 females. Because of variable results from blood inocula in the previous study, only rabbit testis emulsion was used in these patients. The 100 cases were all from a Tokyo hospital and were treated between December 1937 and September 1940. None had been ill with diagnosed syphilis more than 3 years, and one only 3 days. Eighty-seven had never had fever therapy before.

As previously, most cases developed rash. The onset of fever was usually 9 days after injection. Hepato-and splenomegaly was slight. Of those who had not had fever therapy previously, there was some improvement in 78.5%; cerebrospinal fluid and Wasserman test improved in 99.7% and 77%, respectively. The progress of 6 cases with complete and 2 with partial improvement is described. Of the 13 cases who had had previous fever therapy, 1 died and 11 had either complete or partial improvement. There were 4 deaths among the 100 cases. The author remarked that although fever was not high following injection of rickettsiae, it was of long enough duration to do the syphilitics some good. There are 41 references.

- R452 ***Kawahigashi, K.** 1943. On the distribution of tsutsugamushi disease in Kagi district. *J. Formosan Med. Assoc.*, 42(12): 1268 (In Japanese).

A Japanese physician describes 3-1/2 years experience with 20 cases he has seen in the Kagi district (Chia-i Hsien) of Tainan Prefecture. Most (15) were from the coastal plain, the remainder in foothill areas. Cases were widely distributed throughout the coastal plain area. An addendum by M. Rin gives 9 additional cases from Northern Taiwan (6 from Taipei Hsien and 1 from I-lan Hsien), including two from Agincourt (Peng-chia Hsu), a small islet about 60 kilometers northeast of Chi-lung Harbor. He also discusses

1) This article was originally published by Kawamura and Ueda in 1941. See addendum (p. 45).

his experience with 51 cases in which 33 died and calls attention to the much higher mortality rate compared with statistics of other Formosan investigators and Japan proper.

- R450 **Kawahigasi, K.** 1944. On the distribution of tsutsugamushi disease in Kagi district. *J. Formosan Med. Assoc.*, **43**(8): 517-522 (In Japanese).

The author, extending the range of scrub typhus in Kagi district (Chia-i Hsien), reports on 20 cases, divided according to place of exposure: from the mountains and foothills of the Arisan (Alishan) Railroad Line, from other foothills, and from the coastal plain. Four patients in the latter group of 15 were transmigrants. Most cases lacked eschars, but had elevated OXK titers. Characteristics of the 20 cases are given in a table. There were 2 deaths.

- R526 **Ueda, M.** 1945. On the treatment of tabes spinalis with Pescadores strain of tsutsugamushi disease virus. *Nihon Igaku No.* **3361**: 73-77 (In Japanese).

Ueda gives credit to Drs. Kawamura and Nakamura as initiating, in 1936, the use of scrub typhus for fever therapy of syphilitics. Ueda himself had reported the treatment of 20 such cases in 1939 and 100 in 1942. By the time of writing the present paper, he had treated more than 200 cases. The present report, however, lists results with only 10; the other 70 to be reported elsewhere.

As in previous studies, the inoculum was rabbit testis emulsion of a Pescadores strain of *Rickettsia tsutsugamushi* obtained from the Pathology Department of the Kitasato Institute. In several of the cases, however, as before, the inoculum was venous blood from febrile patients. Patients experienced fever from 2 to 15 days after inoculation. Fever was highest at midnight, reaching almost 40°C. After scrub typhus infections subsided, all 10 patients received salvarsan. The group included 1 female, and ranged in age from 32 to 50, with symptomatic syphilis of 2 to 10 years duration. Five cases were completely cured, 3 showed some improvement and the one remained unchanged. This was a patient who died 6 months later of tuberculosis and also had "chronic intoxication with narcotics." Cerebrospinal fluid in 5 cases became normal. Of 6 cases tested, Wasserman's reaction was negative in 3 and improved in 3, although for this observation the tests were made from 3 days to 3 years and 5 months later. Serum Wasserman reactions were negative in 2 cases, improved in 2 and remained unchanged in 1 out of a total of 5 cases tested. The author gives clinical notes on 3 cases. In his conclusion he once again claims that scrub typhus therapy is superior to malaria fever therapy for tertiary syphilis. There are 20 references.

- R041 **Tu, Tsungming.** 1951. Development of medical science in Formosa. *J. Formosan Med. Assoc.*, **50**(11): 263-267 (In English).

This was the presidential opening address for the 44th annual meeting of the Formosan Medical Association. Professor Tu briefly described the history of "Western Medicine" in Taiwan, including the accomplishments of such great men as Patrick Manson,

Ringer, Ogata, Hatori, Morishita, and others. He credits Nakagawa in 1908 as first noting the existence of scrub typhus in Hualienkang (Hualien) and Hizume and Horiuchi with discovery of murine typhus, then called two-week fever, in 1909.

- R444 *Ch'en, C. S., P. Lin, C. Lu and P. Wang. 1951. Scrub typhus in Peng-hu (Pescadores). *J. Formosan Med. Assoc.*, 50(11):277-278 (In Chinese).

Abstract of a meeting presentation in which the authors report on 372 cases of scrub typhus that occurred in the Pescadores in 1951. Few clinical observations are given. Seventy-nine percent of the cases were from Yu-weng and Peng-hu islands and 76% of the cases were in children under 15 years of age. Of the total, 207 were civilian and 165 military. More military men than young men in the civilian population acquired the disease. The latter were considered immune. The male/female ratio was 2 to 1. Peak incidence was in July with 63% of all cases occurring then. There were 5 deaths among the military and none in civilians. Seven cases were studied in detail. In these, chloramphenicol was thought to have reduced duration of fever to about one-half the normal time. Immune serum was recommended as a future preventive measure but not used. An addendum by T. Y. Huang (= T. Ko) states that even though the need for control measures has long been recognized, outbreaks continue to occur. Huang commented on his experience with regard to rash in Ping-tung Hsien on Taiwan proper saying rash always occurred. He also stated that duration of fever was about 8 days for children under 5 years of age but longer in adults. The mortality rate in southern Taiwan was about 10%. Other questions and answers are included in this abstract. In response to one, Dr. Ch'en said 82.3% of his Pescadores cases had rash.

- R024 Prezyna, A. P., T. L. Chang, T. L. Wang, W. J. Dougherty and H. B. Bond. 1954. Treatment of scrub typhus in the Pescadores Islands with Chloramphenicol, Aureomycin and Terramycin. *Amer. J. Trop. Med. Hyg.*, 3(4):833-838 (In English).

Personnel from a U. S. Fleet Epidemic Disease Control Unit teamed with the Nationalist Chinese National Defense Medical Center to study effects of antibiotic treatment on Chinese military personnel on the Pescadores Islands during 1952. Forty-seven cases were treated. All antibiotics were effective, but "relapses" occurred if patients were treated before the 7th day of illness. Forty-eight of 50 cases had eschar and all had fever. Mouse inoculation was positive in 9 of 18 attempts. Only Weil-Felix serologies were done and OXK titers were elevated in all but one case.

- R488 Chen, C. S. and Y. Z. Zhen. 1960. Chronological transition of several infectious diseases during the past ten years, particularly the present state of tuberculosis in Penghu. *J. Formosan Med. Assoc.*, 59(11-12):1475-1476 (In Chinese).

Abstract of a meeting presentation in which scrub typhus statistics are described in only sections of part B. In the past 10 years (not stated by the author but presumably 1950-1959) there were more cases in males than females (63 versus 37 percent). Most

cases were stated to occur in children aged 4 or younger but this observation is not supported by any data. The authors state that since 1952, mortality and morbidity from scrub typhus in the Pescadores were abruptly lowered. Part A, the remainder of part B, and part C are concerned with tuberculosis, other infectious diseases and parasites, respectively.

- R487 *Lin, M. T. and C. F. Huang. 1960. Survey of *T. akamushi* in Orchid Island. *J. Formosan Med. Assoc.*, 59(11-12): 1476 (In Chinese).

Abstract of a meeting presentation in which the authors report on a chigger survey to Orchid Island, inhabited then by 1700 Yami tribesmen and 600 prisoners and government personnel. Chiggers were collected from wild rats, house rats, chickens, turkeys, goats and pigs. The report is of little value since no attempt was made to identify the chiggers or tabulate host infestation rates.

- R486 Kung, K. S. 1961. Tsutsugamushi disease and its control. *Pao Chien Yueh Kan (Monthly Health Magazine)*, published by the Chinese Ministry of National Defense; now called *Chuan Yi Wen Tsui, Compendium of Military Medicine*, 4(10): 16-22 (In Chinese).

A general article, apparently intended for a Chinese military practicing physician audience. Besides general comments and sections on epidemiology, WWII experience by Allied Forces, diagnosis, treatment, pathology and prevention, there is mention of the disease as it occurs in the Pescadores Islands. An outbreak occurred in the Pescadores between May and October 1951, with 412 cases, of which 186 were military. There were 5 deaths. Most cases occurred on the main island of Peng-hu and next on Yu-weng Island. In March 1957, an environmental survey was conducted and recommendations made for rat control, etc. Eight references are all to textbooks or unpublished government reports.

- R489 Su, Y. H. 1961. Diseases in Pescadores, Report 5. Acute infectious diseases. *J. Formosan Med. Assoc.*, 60(2): 1166 (In Chinese).

Abstract of a meeting presentation in which the author summarizes 3,926 infectious disease hospital admissions in the Pescadores Islands from April 1952 to March 1960. Of this total, only 86 cases of scrub typhus were admitted to the Peng-hu provincial hospital (civilian). There were more females than males and mortality was low, although numbers are not given. Eschars most often occurred in the inguinal region in adults, on the abdomen or armpit in school children, and on the earlobe or head in infants.

- R542 *Kawashima, K. and I. Miyazaki. 1962. Notes on the trombiculid mites in Formosa (I). *Jap. J. Sanit. Zool. (Eisei Dobutsu)* 13(2): 159 (In Japanese).

Abstract of a presentation on the status of *Trombicula akamushi* of Formosa. The authors examined a large collection of Formosan chiggers which had been obtained in Karenko Prefecture (Hualien Hsien) and stored at Kyushu University. Although the

material examined is similar to *T. deliensis* of Walch with respect to the number of dorsal setae, the authors prefer to treat it as *T. akamushi* for the present. However, they do point out that specimens are closely related to *T. deliensis* of South Asia.

- R490 **Wu, T. M.** 1962. I. Studies on scrub-typhus of Penghu Hsien (The Pescadores Island) Taiwan. *J. Formosan Med. Assoc.*, **61**(6): 519 (In English).

The title only of a presentation to the annual meeting of the Formosan Medical Association.

- R536 **Hsu, S. H., W. C. Cooper and W. F. Chen.** 1963. Scrub typhus in the Pescadores Islands; an epidemiologic and clinical study. *J. Formosan Med. Assoc.*, **62**(6): 507 (In English).

The title only of a presentation to the annual meeting of the Formosan Medical Association.

- R449 ***Kawashima, K.** 1964. Systematic studies on the trombiculid mites of *akamushi* group. (I) Morphological characters of *Trombicula akamushi* larvae from Formosa. *Jap. J. Sanit. Zool.* (Eisei Dobutsu), **15**: 119 (In Japanese).

Abstract of a presentation on the comparative morphology of *Trombicula akamushi* of Formosa with *T. akamushi* of Japan and *T. deliensis* of South Asia. The author examined material collected off *Rattus norvegicus* and *R. rattus*, or possibly *R. losea*, which had been obtained from Karenko Prefecture (Hualien Hsien) between 1934-38 and stored at Kyushu University. His findings indicate *T. akamushi* of Formosa is similar to that of Japan with respect to the palpal formula, measurements of the scutum and the ratio of pw/coxa II, but differed in regard to the smaller number of dorsal setae which unvaryingly showed a 2-8-6-6-4-2 formula and was typical of Walch's *T. deliensis* of Sumatra. The smaller length of PSB in the Formosan specimens, which was closer to *T. deliensis* of South Asia, was not considered of importance. He concludes that *T. akamushi* of Formosa is intermediate between true *T. akamushi* of Japan and *T. deliensis* of South Asia.

- R048 **Cooper, W. C., J. C. Lien, S. H. Hsu and W. F. Chen.** 1964. Scrub typhus in the Pescadores Islands: an epidemiologic and clinical study. *Amer. J. Trop. Med. Hyg.*, **13**(6): 833-838 (In English).

This paper supplements that of Lien et al. (1967), giving the isolation results of *Leptotrombidium deliense* collections made by Dr. Lien and co-workers during the 1962 outbreak of scrub typhus. Forty-five of 142 *L. deliense* pools tested by mouse inoculation were positive. Of these, 27 of 70 pools from the shrew, *Suncus murinus*, were positive. Clinical symptoms in 5 Chinese soldiers, aged 21-40, are also described. All 5 had fever, frontal headache, and eschars. Two had generalized adenopathy and 3 had splenomegaly but none had rash. Leukopenia occurred in four and an abnormal BSP in one. SGOT and SGPT were normal in all. Three had a fourfold or greater rise in OXK titers.

Rickettsiae were isolated from blood of all 5, from eschars of 4 and bone marrow of 2, but not from urine. Fig. 3 lists reported cases from May to September 1962 by age and sex. Most cases were less than 10 years old. There were 54 females and 45 males. In addition to documenting the first isolation of *Rickettsia tsutsugamushi* from wild caught chiggers in the Pescadores Islands, this paper correctly identifies the vector chigger as *L. deliense* and not *L. akamushi* as previously reported.

- R543 **Kaneko, K. and R. Kano.** 1966. Notes on two species of trombiculid mites (Trombiculidae, Acarina) in Taiwan. *Jap. J. Sanit. Zool.*, **17**: 169-172, Figs. 1-5 (In English).

The authors report on two trombiculid mites, *Wartonia iwasakii* and *Eutrombicula ablephara*, not previously recorded from Taiwan. The former is redescribed and illustrated. They failed to note Domrow's 1962 paper (*Treubia*, 26, Pt 1:3) which synonymized *W. iwasakii* under *W. prima* Schluger 1959.

- R430 **Chiang, T. Y. and S. H. Hsu.** 1966. Scrub typhus control in the Pescadores Islands. Unpublished abstract of a presentation at a NAMRU-2 Symposium, 3-5 March 1966 (In English).

According to these authors, there were 284 cases of scrub typhus with 16 deaths from 1932-1938 but no cases from 1939-1950. Then an outbreak of 412 confirmed cases with 5 deaths in 1951 was reported (Ch'en et al., 1951, document only 372). There have been fewer cases since 1952 because of "Adequate medical treatment and proper preventive measures." Similarly, an outbreak which occurred in 1962 was rapidly controlled through the next 4 years by use of insecticides and rat poisoning.

- R427 **Lien, J. C. and H. M. Lin.** 1966. A field experiment on the efficacy of the insecticides BHC and Diazinon against the chigger vector of scrub typhus in the Pescadores. Unpublished abstract of a presentation at a NAMRU-2 Symposium, 3-5 March 1966 (In English).

The abstract in its entirety reads "In May 1963 a field experiment on the efficacy of the insecticides BHC and Diazinon against the chigger vector of scrub typhus, *Leptotrombidium deliense*, was carried out in the main island of the Pescadores. The insecticides consumed were 1,600 kg of 6.5% BHC wettable powder and 193 kg of 40% Diazinon wettable powder. Chigger breeding sites, namely *Miscanthus* fields, bases of coral wall, leucaena fields and the margins of cultivated fields were sprayed with the insecticides at a rate of 250 mg of technical insecticides per square meter of surface area in all cases. Power sprayers (Fontan) and hand sprayers (Hudson) were used. Three villages received BHC spraying, and another three received Diazinon spraying. Comparison of the mite population in the first 6 months in the previous year indicates that the mite population decreased to 7.5-16.9% in the village where the insecticides were sprayed with power sprayers, and to 21.1-56.2% in the villages where the insecticides were sprayed with hand sprayers, whereas the mite population increased to 112.6-350.1% in

the village where no insecticides were sprayed. Both BHC and Diazinon showed similar degree of efficacy against the mite."

- R426 **Lien, J. C., S. Y. Liu and H. M. Lin.** 1966. Observation on the seasonal fluctuation of *Leptotrombidium deliense* in the Pescadores. Unpublished abstract of a presentation at a NAMRU-2 Symposium, 3-5 March 1966 (In English).

The data in this unpublished abstract are summarized in the annotation of Lien et al., 1967.

- R118 **Lien, J. C., S. Y. Liu and H. M. Lin.** 1967. Field observation on the bionomics of *Leptotrombidium deliense*, the vector of scrub typhus in the Pescadores. *Acta Med. Biol.*, 15. Suppl. : 27-31 (In English).

An important article which firmly establishes *Leptotrombidium deliense* as the only external, mammalian chigger mite on the islands, and not *L. akamushi* as previously reported. Chiggers were collected in the Pescadores Islands by recovery from trapped mammals, from sentinel mice and from bakelite plates between September 1961 and November 1963. Seasonal abundances were obtained. These have recently been analyzed and found to correlate with temperature (Van Peenen, Lien, Santana and See, in press). Foci of chigger abundance are listed in order of highest yields. *Miscanthus* grass was highest. Other than *L. deliense*, only one other mammalian chigger was encountered, an undetermined, intranasal species of *Doliosia*. Ten other species of trombiculid mites, including *Eutrombicula wickhami*, were found on birds or reptiles.

- R544 **Nadchatram, M. and F. J. Radovsky.** 1971. A second species of *Vatacarus* (Prostigmata, Trombiculidae) infesting the trachea of amphibious sea snakes. *J. Med. Ent.*, 8(1) : 37-40, Figs. 1-8 (In English).

Vatacarus kuntzi, n. sp., is described from material found in the trachea of a sea snake collected at Lan-yu (Orchid Island, Botel Tobago), a small island east of the southern tip of Taiwan.

- R545 **Brennan J. M. and A. B. Amerson.** 1971. Six new species and additional records of chiggers from the Central Pacific (Acarina: Trombiculidae). *J. Parasitol.*, 56(6) : 1311-1317 (In English).

Although not concerning Taiwan, this paper includes comments on the status of *Neoschoengastia gallinarum* (Hatori). The unknown whereabouts of Hatori's type material leaves the precise identity of this species in question.

- R158 **Lien, J. C., C. I. Cheng and S. C. Lien.** 1974. A team approach to a disease survey on an aboriginal island (Orchid Island, Taiwan). IV. Mosquitoes and chiggers on Lan-yü (Orchid Island), Taitung Hsien, Taiwan. *Chinese J. Microbiol.* 7 : 36-41 (In English).

This is the fourth in a series of papers reporting results of an April 1968 NAMRU-2

survey on Lan-yü. Only 2 species of chiggers were encountered: *Leptotrombidium deliense* and *Eutrombicula wichmanni*. The former was commonly found on *Rattus* and occasionally on domestic goats whereas the latter was usually found on goats and chickens but rarely rats (*R. rattus* 1 of 18 examined). In the last sentence of the discussion, the authors state that scrub typhus rickettsiae have been isolated from *L. deliense* on Lan-yü according to "Anon. 1964. Taiwan's Health 1963. Dept. of Health, Taiwan Provincial Government, Republic of China. p. 182."

- R159 **Kundin, W. D., G. S. Irving and G. L. Raulston.** 1974. A team approach to a disease survey on an aboriginal island (Orchid Island, Taiwan). V. Arboviral, rickettsial and *Brucella* antibodies on Orchid Island. *Chinese J. Microbiol.*, **7**:42-46 (In English).

This is the last paper in the series and gives results of IFA and passive hemagglutination modification of the *Proteus* OXK test for scrub typhus. Titers of 1:40 or greater were considered positive. Sera were from indigenous Yami aborigines or Chinese military.

Of 153 Yami sera tested, 31 were OXK positive but IFA negative, 51 were IFA positive but OXK negative and only 25 were positive by both tests. Considering IFA test results only, antibodies increased by age. Two of 25 Chinese military were positive by IFA. Animal and human sera were also tested by Weil-Felix; OXK antibodies at 1:40 dilution were present in 1 of 60 pigs and 3 of 30 goats. The authors state "the significance of the presence of antibodies against *Proteus* OX-19 in 4 human and 11 animal sera is uncertain."

- R037 **Fang, R. C. Y., W. P. Lin, P. S. Chao, N. T. Kuo and C. M. Chen.** 1974. Haematological studies in scrub typhus. *Asian J. Med.*, **10**:193-200 (In English).

The authors' report on the hematological findings of 47 Chinese Army Garrison Force and Air Force ground personnel. Only cases with eschar were included. The abstract reads as follows "The haematological findings of 47 cases of scrub typhus from May to September, 1973 on Penghu (The Pescadores) are reported. The diagnosis was established by the presence of eschar, typical clinical manifestations and a rise in OX-K titer. The leucocyte count varied from 3,200 to 14,500/CMM. Leucopenia was present in 11 cases. Lymphocytosis was demonstrated in 76% of examinations in the febrile stage and 96% of examinations in the convalescent stage. Increase in ESR was noted both in the febrile and convalescent stages. It is postulated that the pathogenic organism may depress the marrow during the acute stage of illness in certain cases. Myeloid hyperplasia in the bone marrow was found in 12 cases (48%) during the febrile stage. However, 47% of patients were found with erythroid hyperplasia. No patient was found with anaemia, except one patient who was considered to have acquired scrub typhus through a blood transfusion from a donor with rickettsemia."

- R005 Gale, J. L., G. S. Irving, H. C. Wang, J. C. Lien, W. F. Chen and J. H. Cross. 1974. Scrub-typhus in eastern Taiwan. 1970. *Amer. J. Trop. Med. Hyg.*, **23**(4): 679-684 (In English).

The abstract reads "An outbreak of scrub typhus occurred in Chinese army personnel in the eastern part of Taiwan during 1970. This is the first outbreak of this disease documented on the main island of Taiwan since 1932. Of 21 hospitalized patients examined during the convalescent stage, 19 had antibody titers of from 1 to 640 to one to 10,240 as measured by indirect immunofluorescence to the Karp, Kato and Gilliam strains of *Rickettsia tsutsugamushi*. All were males of from 35 to 51 years and all had high fever by history. Eleven patients had eschars, 6 with typical black necrotic scabs. In addition, serologic evidence of prior scrub typhus infection was found in 59 of 241 other men from the 2 military companies involved in the outbreak. All men had been working clearing an area in hills 300 to 500 meters high. This land was originally cleared for agricultural use, but had been abandoned over 4 years previously. *Rickettsia tsutsugamushi* was recovered from rodents and chiggers (*Leptotrombidium deliense*) captured in the area."

Mammal and chigger isolation results were based on mouse inoculation and are somewhat confusing. They report that rickettsiae were seen in spleen impression smears or ascitic fluid stained with Giemsa from mice inoculated with tissues from 3 wild rats (1 *Rattus* species and 2 *R. coxinga*), but in Table 3 they indicate rickettsiae were also seen in the spleen smear of mice inoculated with the spleen of a bandicoot rat, while Karp challenge of chloramphenicol-protected mice injected with this isolate was negative. The reverse of the bandicoot example occurred in material from 2 of the 5 wild rats that were considered positive by spleen tissue isolation, i.e., rickettsiae were not seen in impression smears, but mice receiving spleen material from these rats survived challenge with a lethal Karp strain. The reported recovery of rickettsiae from 1 pool of *Leptotrombidium deliense* represents the first isolation of *R. tsutsugamushi* from wild caught chiggers on Taiwan.

- R085 Fang, R. C. Y., W. P. Lin, P. S. Chao, N. T. Kuo and C. M. Chen. 1975. Clinical observations of scrub typhus on Penghu (The Pescadores Islands). *Trop. Geogr. Med.*, **27**(1975):143-150 (In English).

This paper records the authors' experience with 68 military cases of scrub typhus from the Pescadores between May and September 1973. Two were military-associated women. Headache occurred in 58, eschar in 56, and 24 had rash. Only 1 had a palpable spleen. SGOT was considered elevated in 22 of 50 and BUN in 21 of 49. There were 9 of 50 with "false positive" VDRL's. Thirty tests (no denominator) had OXK titers of 1:160 or greater. An interesting possible case of blood transfusion induced scrub typhus is briefly described. One patient reportedly had had scrub typhus 6 years previously without sequelae. The authors concluded that tetracycline, 500 mg 4 times daily for one week, is the treatment of choice.

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- R531 ***Akashi, K., T. Yoshimura** and **H. Yo.** 1933. On Weil-Felix reaction with sporadic spotted fever. *J. Formosan Med. Assoc.*, **32**(12): 1808-1809 (In Japanese).
- R545 **Brennan J. M.** and **A. B. Amerson.** 1971. Six new species and additional records of chiggers from the Central Pacific (Acarina: Trombiculidae). *J. Parasitol.*, **57**(6): 1311-1317 (In English).
- R444 ***Ch'en, C. S., P. Lin, C. Lu** and **P. Wang.** 1951. Scrub typhus in Peng-hu (Pescadores). *J. Formosan Med. Assoc.*, **50**(11): 277-278 (In Chinese).
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- R432 **Hara, Y.** 1932. On the patho-histological changes of lymph gland in tsutsugamushi disease in Formosa. *J. Formosan Med. Assoc.*, **31**(2): 127-134 (In Japanese).

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- R550 **Hatori, J.** 1915. Tsutsugamushi disease in Formosa. *Dobutsu Gaku Zasshi*, **27**(317): 155-156 (In Japanese).
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ADDENDUM

- R551 KAWAMURA, R. and M. Ueda. 1941. Eine neue therapie der Dementia paralytica. 2. Mitteilung. (Durch Impfung mit dem Pescadoresstamm der tsutsugamushik-rankheit). *Ztschr. f. d. ges. Neurol. & Psychiat.*, **174**(3-4): 410-424 (In German). Although this article may represent the first publication of the data, Ueda alone, in 1942, essentially published an identical paper in Japanese (R 516). Multiple publication of the fever therapy articles in more than one language appears to be a common practice by these two authors as their previous papers clearly show. See article by Ueda for annotation.